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## REMARKS/ARGUMENTS

This Amendment is in response to the Office Action mailed 04/12/2004. In that Office Action, the Examiner noted that the reply filed on 01/07/2004 was not fully responsive to the prior Office Action mailed 10/17/2003. This Revised Amendment is intended to replace the reply filed on 01/07/2004. The above listing of claims is presented relative to the claims as originally filed. All the responses previously filed on 01/07/2004 are repeated with appropriate corrections and additions to address the Examiner's concerns expressed in the Office Action mailed 10/17/2003.

In the Office Action dated 10/17/2003, the Examiner objected to the drawings and the specification and rejected (i) claims 7-14 and 31-35 under 35 U.S.C. § 112, (ii) claims 7, 8 and 10-14 and 31-35 under 35 U.S.C. § 102, and (iii) claims 7, 8, 10-14 and 31-35 under 35 U.S.C. § 103. Reconsideration in light of the amendments and remarks made herein is respectfully requested.

The specification has been amended to correct minor informalities.

Claims 7-14 and 31-35 remain in this application.

The Examiner states that the reply dated 7-21-03 is not fully responsive to the prior Office Action because the rejection of claim 13 has not been addressed. In response, Applicants have amended claim 13 to correct the antecedent basis.

### *Objection to Drawings*

The Examiner states that the drawings do not show every feature of the invention specified in the claims. Applicants respectfully disagree. The drawings show all the necessary features in the claims. For example, Figure 3 shows the first underfill material 24 as recited in claims 7, 11 and 31 ("dispensing the first material acting as underfill"), the second underfill material 26 as recited in claims 7, 11 ("dispensing a second material to form a circumferential fillet"), and 31 ("dispensing a second material only around a periphery … to form a circumferential fillet"). Figure 4 shows (1) the substrate 12 initially baked as recited in claims 11 and 31 ("heating the substrate"), (2) dispensing the first underfill material 24 as recited in claims 1, 11 and 31 above; and (3) dispensing the second underfill material 26 as recited in claims 1, 11 and 31 above.

Accordingly, Applicants respectfully request that the Examiner withdraw the objection to the drawings.

***Specification***

The Examiner objects to the specification. In the Office Action, the Examiner stated that trademarks for Semicoat 5230-JP and Semicoat 112X should be capitalized. In response, Applicants have amended the Specification to capitalize Semicoat 5230-JP and Semicoat 112X.

The Examiner further objected to the Specification as being insufficient because proper identification of the product sold under trademarks Semicoat 5230-JP and Semicoat 112X is omitted from the Specification and such identification is deemed necessary. Applicants respectfully disagree. First, the product identification of Semicoat 5230-JP and Semicoat 112X is complete as described in the Specification (see Specification, page 8, lines 19-25; page 9, lines 1-2). Second, the use of these products are merely for illustrative purposes, and not necessary for the principles of the invention.

The Examiner further requested information on the product identified by the trademarks Semicoat 5230-JP and Semicoat 112X under 37 CFR 1.105. As discussed above, these products are specified for illustrative purposes only. Similar products having similar characteristics, i.e., the second underfill material having lower adhesion properties and better fracture/crack resistance than the first underfill material, may be used. However, in compliance with the request, Applicants are attaching the product information in the Appendix A.

Applicants are also including in the Appendix the document KJR Series & SEMICOAT Series, Semiconductor Materials, and information on the Semicoat 112X™.

Accordingly, Applicants respectfully request that the Examiner withdraw the objection to the specification.

Attachment: 27 Annotated Sheets

***Rejection Under 35 U.S.C. § 112***

a) The Examiner rejects claims 7-14 and 31-35 under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. Specifically, the Examiner states that the undescribed subject matter of the claimed invention is the limitations "the second material having a lower adhesive property than the first material" (claim 1), and "...having a lower adhesion property than the first material..." (claims 11 and 32). Applicants respectfully disagree.

Adhesive property is a common property of material used in encapsulating semiconductor devices. Applicants are attaching in Appendix B a product description of the material. Accordingly, Applicants respectfully request that the Examiner withdraw the rejection of claims 7-14 and 31-35 under 35 U.S.C. § 112, first paragraph.

b) Negative Limitation:

The Examiner states that claim 31 contains a negative limitation not supported in the specification. In response, Applicants have amended claim 31 to remove the negative limitation.

c) Genus Limitation:

The Examiner further states that the specification does not reasonably provide enablement for the genus limitation of claim 7. Specifically, the Examiner refer to the "adhesive property" in the claims. As discussed above, the adhesive property is a common property of material used in encapsulating semiconductor devices.

d) The Examiner rejects claims 7-14 and 31-35 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The Examiner states that claims 7-10 are incomplete because claims 7 omits an essential structural cooperation relationship of element. The Examiner further states that the limitation "dispensing a second material acting as a circumferential fillet" does not define a cooperative structural relationship between the second material and the remaining claimed structure. In response, Applicants have amended claim 7. Accordingly, Applicants respectfully request that the Examiner withdraw the rejection of claims 7-14 and 31-35 under 35 U.S.C. § 112, second paragraph.

e) The Examiner further states that no art recognizes definition and quantification of adhesive and adhesion. Applicants respectfully disagree and direct the Examiner's attention to the argument above.

f) The Examiner states that the scope of the limitations "as a circumferential fillet" and "an underfill" is indeterminable. In response, Applicants have amended claims 7, 11 and 31 to clarify the claim language.

Accordingly, Applicants respectfully request that the Examiner withdraw the rejection of claims 7-14 and 31-35 under 35 U.S.C. § 112, first and second paragraph.

***Rejection Under 35 U.S.C. § 102***

The Examiner rejects claims 7, 8 and 10 under 35 U.S.C. § 102(e) as being anticipated by Asai (U.S. Patent 6,376,906) ("Asai"). Applicant respectfully traverses the rejection and contends that the Examiner has not met the burden of establishing a *prima facie* case of anticipation. Namely, to anticipate a claim, the reference must teach every element of the claim. "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Vergegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ 2d 1051, 1053 (Fed. Cir. 1987).

Asai discloses a mounting structure of semiconductor element. A reinforcement resin is injected into a space between a flip chip integrated circuit and a substrate (Asai, col. 1, lines 33-36). During thermal testing, separation of the reinforcement resin from the substrate starts from a joining portion between an edge portion A of the reinforcement resin around the flip chip and the wiring members (Asai, col. 1, lines 41-46).

The Examiner states that Asai discloses dispensing a first material 9 acting as underfill and dispensing a second material 9 acting as a circumferential fillet. Applicants respectfully disagree. Asai merely discloses dispensing one material, namely reinforcement resin 9, in a space between the flip chip IC and the substrate (Asai, col. 1, lines 33-36). In contrast, in the claimed invention, the second material is different than the first material, as amended in claims 7, 11 and 31.

The Examiner further rejected claims 7, 8, 10-14, and 31-35 under 35 U.S.C. § 102(b) as being anticipated by Ameen (0340492) ("Ameen"). Applicant respectfully traverses the rejection and contends that the Examiner has not met the burden of establishing a *prima facie* case of anticipation.

Ameen discloses conformal sealing and interplanar encapsulation of electronic device structures. In Ameen, the overcoat material and the undercoat material are of the same type. They are both formed from a solventless liquid polymer (Ameen, col. 3, lines 10-13; lines 25-28). In the present invention, the second underfill material is different than the first underfill material. As stated on page 6 of the Specification, the second underfill material has lower adhesion properties but much better fracture/crack resistance than those of the first underfill material.

Accordingly, Applicants respectfully request that the Examiner withdraw the rejection of claims 7, 8 and 10 under 35 U.S.C. § 102(e) and claims 7, 8, 10-14 and 31-35 under 35 U.S.C. § 102(b).

***Rejection Under 35 U.S.C. § 103***

The Examiner rejects claim 9 under 35 U.S.C. § 103(a) as being unpatentable over Ameen as applied to claim 8, and further in combination with Bouras (U.S. Patent 5,906,682) ("Bouras"). Applicants respectfully traverse the rejection and contend that the Examiner has not met the burden of establishing a *prima facie* case of obviousness.

Bouras discloses a flip chip underfill system and method. Printed Circuit (PC) boards are heated by conduction in belt ovens having successive air zones (Bouras, col. 2, lines 55-58). A radiant heat source is energized by a PC board heater controller circuit (Bouras, col. 5, lines 33-34).

Ameen and Bouras, taken alone or in combination, does not disclose, suggest or render obvious (1) dispensing a first material to form an underfill which becomes attached to the integrated circuit and the substrate, (2) dispensing a second material to form a circumferential fillet, the second material being different than the first material and having a lower adhesive

property than the first material, and (3) wherein the substrate moves within an oven while the first material flows between the integrated circuit and the substrate.

Bouras merely disclose heating a PC board, not an integrated circuit and a substrate. The heating is performed when all the devices have already been populated on the PC board, not when the first material flows between the integrated circuit and the substrate. Furthermore, the interior chamber in Bouras is used to communicate with the needle and upon which a vacuum is pulled by a vacuum source (Bouras, col. 5, lines 52-54). It is not an oven within which the substrate moves.

The Examiner further rejected claims 7, 8, 10-14, and 31-35 under 35 U.S.C. 103(a) as being unpatentable over Ameen and in combination with Applicant's admitted prior art (AAPA). Applicants respectfully disagree and contend that the Examiner has not met the burden of establishing a *prima facie* case of obviousness.

Ameen and AAPA, taken alone or in combination, does not disclose, suggest, or render obvious (1) dispensing a first material to form an underfill which becomes attached to the integrated circuit and the substrate, and (2) dispensing a second material to form a circumferential fillet, the second material being different than the first material and having a lower adhesive property than the first material.

Ameen does not disclose any of the above elements as discussed above. AAPA merely discloses two types of materials, SEMICOAT 5230JP and SEMICOAT 122X. AAPA does not disclose, suggest or render obvious using these two materials as an underfill and a circumferential fillet.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. MPEP §2143, p. 2100-124 (8th Ed., rev. 1, Feb. 2003). Applicants respectfully contend that there is no suggestion or motivation to combine their teachings and that no *prima facie* case of obviousness has been established

Accordingly, Applicants respectfully request that the Examiner withdraw the rejection of claims 7, 8, 9-14, and 31-35 under 35 U.S.C. § 103(a).

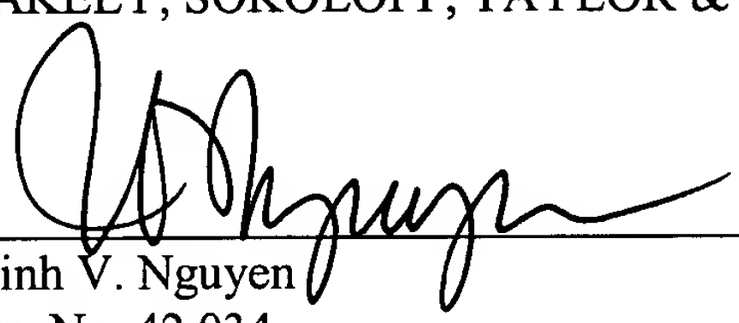
***Conclusion***

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Dated: 04/21/2004

By 

Thinh V. Nguyen
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12400 Wilshire Boulevard, Seventh Floor
Los Angeles, California 90025

# Semiconductor Materials

## Semiconductor Materials and Production Process Materials

As a super supplier of semiconductor-related materials, we supply silicon wafers and a wide variety of materials indispensable to the manufacture of semiconductors. We also supply gases, chemicals, fixtures, etc. for use in production processes.

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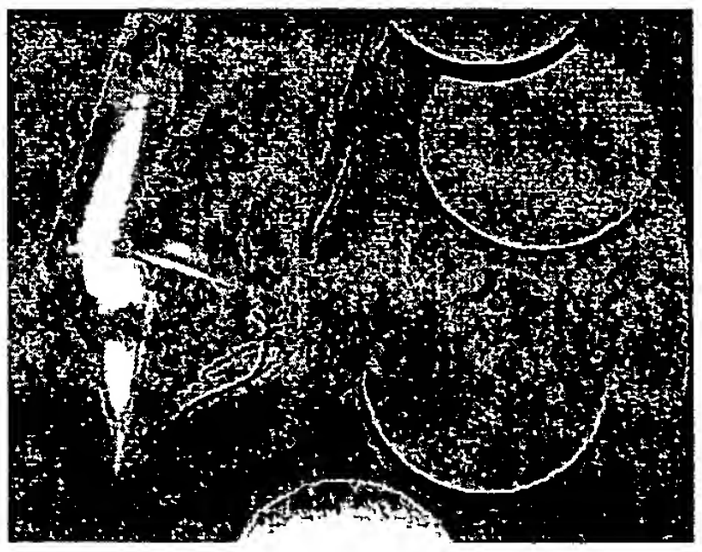
## [Semiconductor materials]



### 300mm silicon wafers

For inquiry 8

With the arrival of the era of full-scale mass production of 300mm wafers, customers' expectations on silicon wafers are increasingly high. As a pioneer in the world silicon market, Shin-Etsu Handotai (SEH) took the head start of the mass production of 300mm and has established a system ensuring a stable supply to the market. In responding to even higher requirements from the customers for the future, we continue the incessant efforts and challenges for the quality improvements.

Features
- We have respond to the growing market demand in timely manner with our capacity expansions since the starting of the mass production in February 2001.
- Our products can meet the 0.13um design rule process and beyond.
- Our product portfolio covers wide range of the customers' various requirements.

Applications
- Substrates for memory devices, microprocessor devices, etc.

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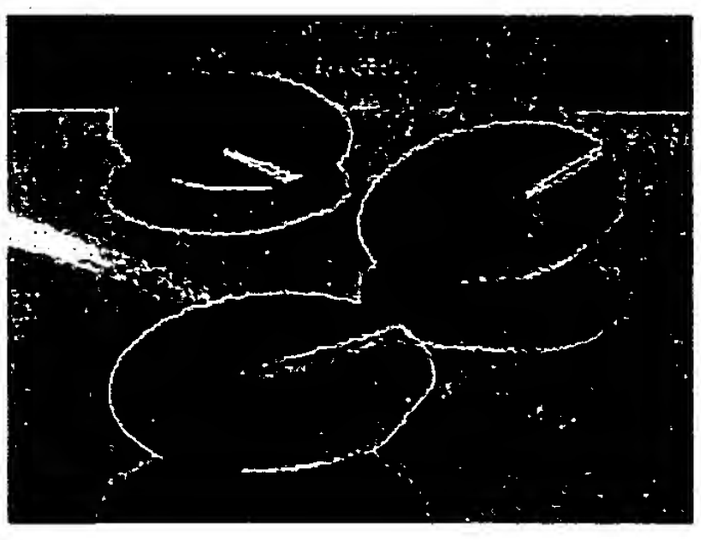


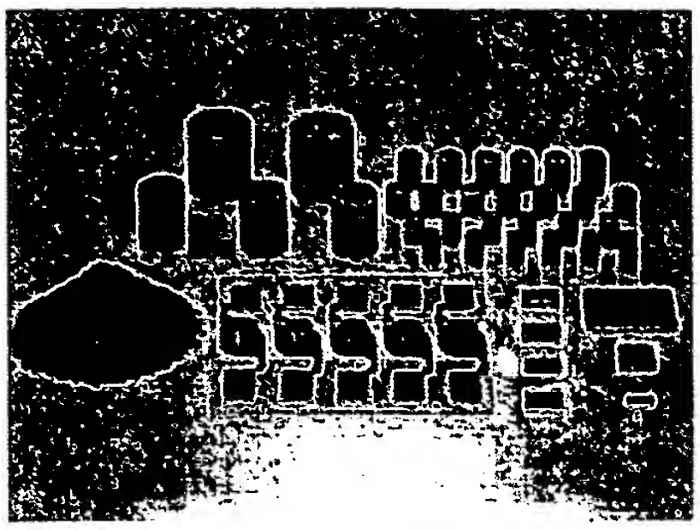
### IG-NANA wafers

For inquiry 8

IG-NANA wafers (annealed wafers) can be used in wide range of device processes, from high-temperature processes to low-temperature processes. This product can provide high device performances at a reasonable cost.

Features
- Enhancement of the "getter effect" is achieved with the presence of highly-densed and highly uniformed BMD in the bulk.
- The surface layer is defect-free.
- Suitable for advanced technology processes with narrow design rule
- Available also in 300mm

Applications
- Substrates for memory devices, logic devices, etc.



## Epoxy molding compounds

For inquiry 6

These encapsulating materials provide low stress, low alpha-ray property and high thermal conductivity.They are also environment-friendly.

Features
- Superior moisture resistance, electrical characteristics, and moldability. This material meets the high requirements for resin encapsulation of devices.
- By introducing a new, original flame-retardant system, this product is free from halogen and antimony trioxide.

Applications
- D-RAM and other LSI molding, full pack molding for power devices etc.

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## Liquid epoxy encapsulating materials

For inquiry 6

This is a liquid epoxy resin encapsulating material for the protection and adhesion of semiconductor devices.

Features
- Excellent low stress, adhesive, and penetration property

Applications
- Under filling, COB potting, hermetic seal, and other uses for electrical or mechanical protection and highly reliable adhesion of semiconductor devices

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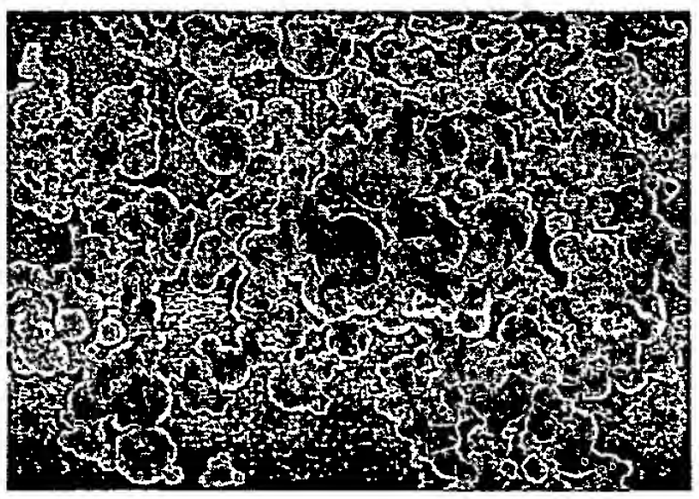

## True spherical shape ultra-fine particulates "ADMAFINE"

For inquiry 19

ADMAFINE is true spherical shape ultra-fine particulates produced using a special process of oxidize metallic powder. Admatecs, a joint venture of Toyota Motor, Shin-Etsu Chemical, Shin-Etsu Quartz Products and Tatsumori, succeeded in commercial production of this product as a pioneer in the world.

Features
- The true spherical shape ultra-fine particulates have a sharp granular distribution, capable of improving the toughness, flowability, thermal conductivity and other physical properties of composite materials.
- Not only simple oxide but also of composite oxide fine spherical particulates can be produced.
- It is possible to coat the particles with various types of composites or classify the particles.

Applications
- Filler material for semiconductor enclosure applications
- Filler material for precision resin molding applications
- Anti-blocking materials
- Sintering materials

# For More Information

Shin-Etsu
http://www.shinetsu.co.jp/

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|---|---|---|---|
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| 3 | Silicone Division<br>Sales and Marketing Dept. IV | +81-3-3246-5153 | |
| 4 | Electronics Materials Division<br>Rare Earths & New Materials Dept. | +81-3-3246-5252 | |
| 5 | Electronics Materials Division<br>Magnet Dept. | +81-3-3246-5246 | http://www.shinetsu-rare-earth-magnet.jp/ |
| 6 | Electronics Materials Division<br>Organic Electronics Materials Dept. | +81-3-3246-5231 | |
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| 16 | Shin-Etsu Polymer Co., Ltd.<br>Electronics Material Handling Products Division | Silicon wafer carrier and semiconductor-material container<br>+81-48-652-6290<br>Carrier tapes<br>+81-48-652-6040 | http://www.shinpoly.co.jp/ |
| 17 | Shin-Etsu Polymer Co., Ltd.<br>Connector Division | +81-48-652-5913 | http://www.shinpoly.co.jp/business/connector/ |
| 18 | Shin-Etsu Polymer Co., Ltd.<br>RC Division | +81-48-652-5912 | http://www.shinpoly.co.jp/ |
| 19 | Shin-Etsu Quartz Products Co., Ltd. | +81-3-3348-1913 | http://www.sqp.co.jp/ |
| 20 | Shin-Etsu Film Co., Ltd. | +81-3-3259-1061 | http://www.shinetsu-film.co.jp/ |
| 21 | Shinano Electric Refining Co., Ltd. | +81-3-5298-1601 | |

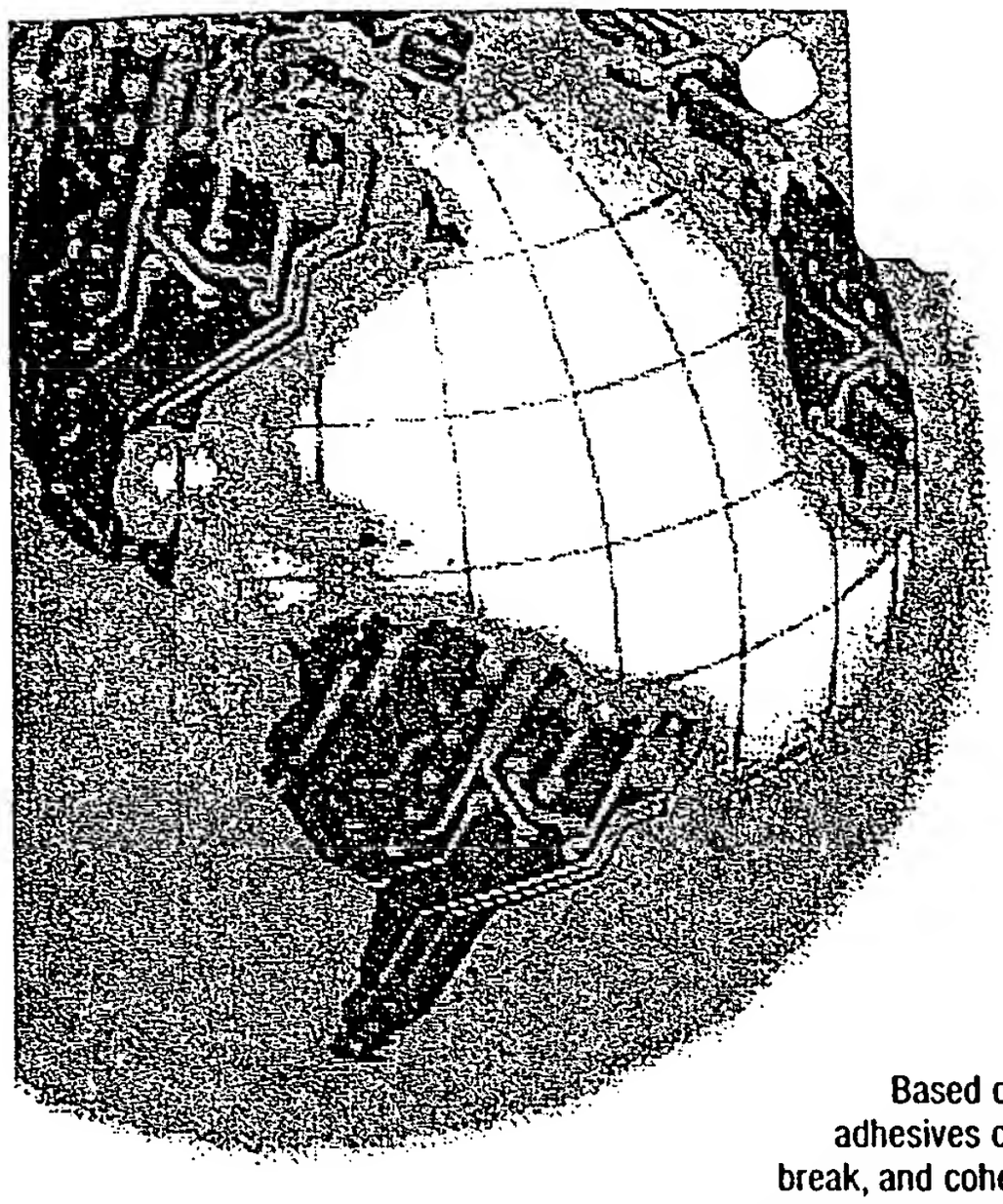
SEMICONDUCTORS

# Potting for PGA, BGA etc.

| ITEM | | UNIT | Product Name | SEMICOAT 114 | SEMICOAT 115 | X-43-5012A | SEMICOAT 122 | SEMICOAT 124*1 |
|---|---|---|---|---|---|---|---|---|
| | | | Feature | Low viscosity | Low viscosity<br>Low stress | Low stress<br>Good Adhesion | Low stress<br>Small warpage | Low stress<br>Flame resistance |
| | | | Aspect Ratio*2 | 0.10 | 0.05 | 0.05 | 0.05 | 0.05 |
| Appearance | | | | Black | Black | Black | Black | Black |
| Viscosity | 25℃ | poise | | 55 | 400 | 1000 | 400 | 900 |
| Gelation Time | 150℃ | sec | | 60 | 70 | 70 | 60 | 70 |
| Flexural Strength | 25℃ | kgf/mm² | | 8 | 10 | 10 | 11 | 10 |
| Flexural Modulus | 25℃ | kgf/mm² | | 450 | 1100 | 1300 | 1300 | 1000 |
| Coefficient of Thermal Expansion | α1 | ppm/℃ | | 45 | 20 | 15 | 15 | 20 |
| | α2 | ppm/℃ | | 140 | 80 | 60 | 60 | 80 |
| Glass Transition Temp. | | ℃ | | 135 | 145 | 145 | 155 | 145 |
| Volume Resistivity at 25℃ | | Ω cm | | 2×10¹⁶ | 2×10¹⁵ | 2×10¹⁵ | 2×10¹⁶ | 1×10¹⁶ |
| Dielectric Constant at 1kHz | | | | 4.0 | 3.5 | 3.3 | 3.6 | 3.5 |
| Recommended Cure Condition | | | | 100℃/1Hr+150℃/1Hr | 100℃/0.5Hr+150℃/2Hr | 100℃/0.5Hr+150℃/2Hr | 100℃/1Hr+150℃/2Hr | 100℃/0.5Hr+150℃/2Hr |
| Dispense Condition(Device Temp.) | | ℃ | | 22～50 | *70～90 | *70～90 | *70～90 | *70～90 |
| Storage Condition | | ℃ | | Below－5 | Below－5 | Below－5 | Below－40 | Below－5 |

* to avoid trapping air in dispense process.

*1 UL94V-0 recognized component



# Hysol® Die Attach Adhesives

Elevated lead-free processing temperatures demand electronic packaging materials that can withstand polymer decomposition during reflow, increased interfacial stresses, and loss of adhesive and cohesive strength.

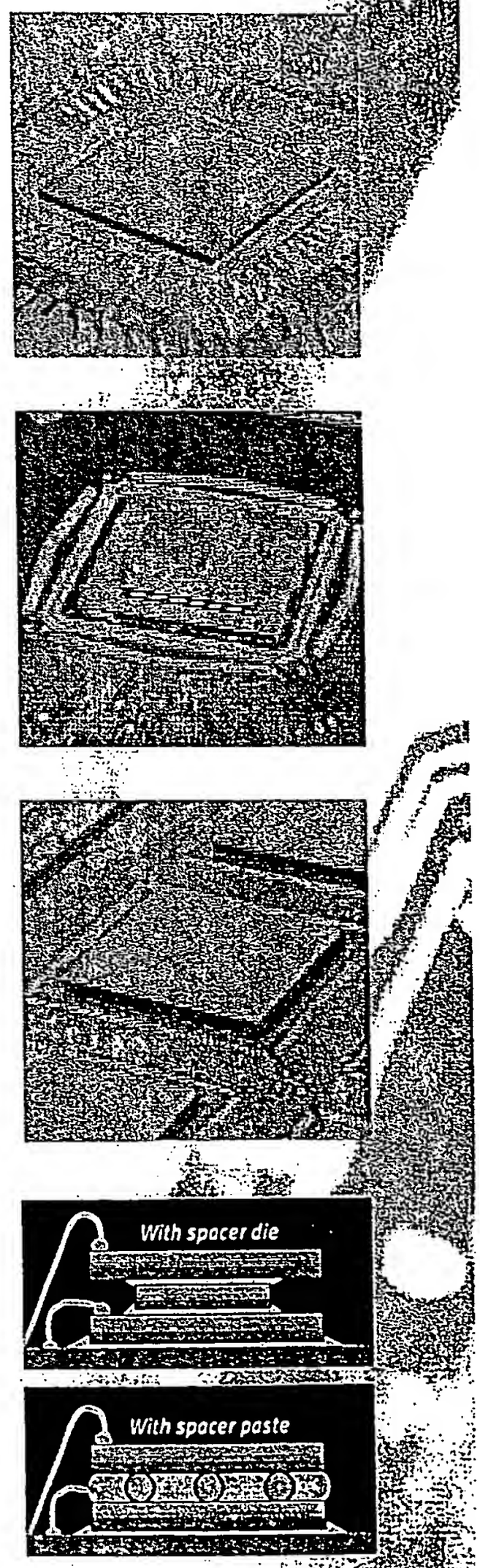
Based on ultra-hydrophobic chemistry, Hysol® die attach adhesives offer very high adhesive strength, elongation at break, and cohesive energy at high reflow temperatures. These properties help electronic packages retain adhesive strength and structural integrity during moisture soak and absorb stresses during the deformations associated with lead free reflow processing.

Designed to deliver superior quality and reliability, Hysol® die attach adhesives have won a number of supplier quality awards. Several products are formulated with PTFE, an extremely low dielectric constant material that will not abrade polyimide and other die passivation.

Our fast reaction kinetics and solvent-free formulation enables inline SkipCure™ processing that increases UPH for adhesive cure, eliminates the need for separate curing equipment, and decreases package warpage. Our adhesives for organic substrates eliminate substrate prebaking, while our patented polymeric spacers deliver consistent bondline thickness, reduce tilt, and enable high UPHs for die placement.

With our products, our customers can use conventional oven cure as well as snap cure, and when they are ready, they can also Skipcure and SkipPrebake[1]. Our organic products can also be converted to their CCSP™ (controlled collapse spacer paste) versions without changing the base paste properties. The ability to exercise these three options, Skipcure, SkiPrebake[1], and Spacers at zero or minimal switching costs allow lower cost of use and lower cost of ownership for our customers equipment.

[1] *For products designed for organic laminates*




*Eliminates the need for dummy die in the stack by using spacers in the adhesive*

www.loctite.com/electronics

# Hysol® Die Attach Adhesives for Non-Hermetic Packages

## For organic substrates including laminates, array, BGA and CSP packages

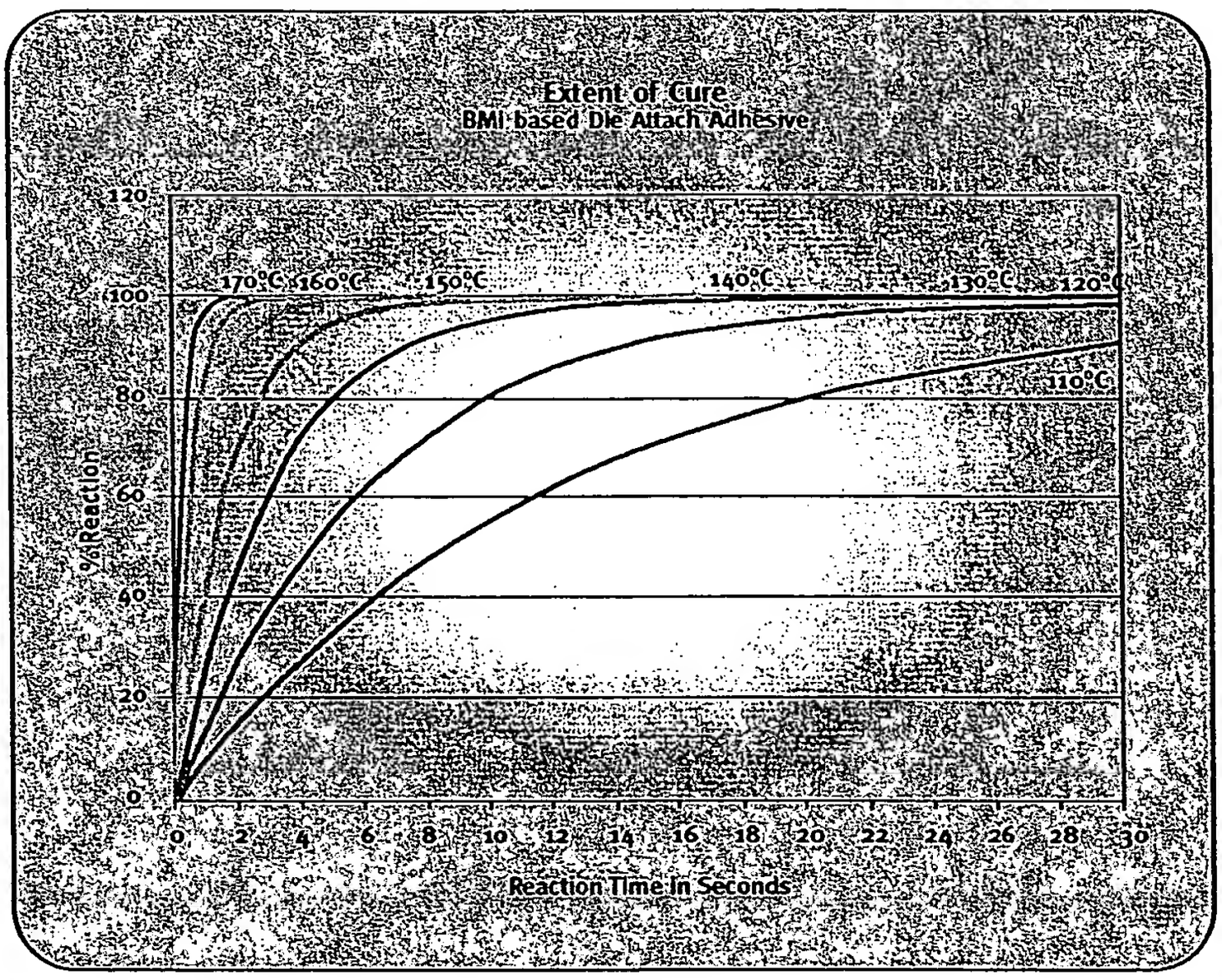
| Materials | Description/Application | Resin | Filler | Oven Cure /SkipCure® | Viscosity 5rpm@ 25°C | Thermal Conductivity | Tg* (°C) | CTE α1/α2 | Modulus @ 25°C | Storage Temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| QMI 550 | **Stacked Die In CSP, BGA** Dielectric, very high adhesive and cohesive strength and elongation at Pb-free reflow temperatures | BMI | PTFE | 15 min. @ 150°C Oven 10 secs. @ 150°C SC | 11500 cps | 0.2 W/m°K | -10 | 91 150 | 1.0 GPa | -40°C |
| QMI 536 | **Industry Standard** De facto industry standard for die-to-die bonding; dielectric, high adhesive strength material for organic substrates | BMI | PTFE | 15 min. @ 150°C Oven 10 secs. @ 150°C SC | 9000 cps | 0.3 W/m°K | -31 | 93 174 | 0.30 GPa | -40°C |
| QMI 536HT | **High Thermal Version of QMI 536** Dielectric, high thermal conductivity adhesive for organic laminates and die-to-die bonding, ideal for mixed stacked die applications | BMI | Boron Nitride | 15 min. @ 150°C Oven 10 secs. @ 150°C SC | 13000 cps | 0.9 W/m°K | 4 | 66 177 | 0.85 GPa | -40°C |
| NEW QMI 550SI | **Low CTE Version of QMI 550** Silica-filled for low shrinkage and low warpage on laminate and flex substrates | BMI | Silica | 15 min. @ 150°C Oven 10 secs. @ 150°C SC | 17000 cps | 0.6 W/m°K | 33 | 43 91 | 1.50 GPa | -40°C |
| NEW QMI 550EC | **Electrically Conductive** Silver-filled version of QMI 550; very high adhesive and cohesive strength | BMI | Silver | 15 min. @ 150°C Oven 10 secs. @ 150°C SC | 17000 cps | 3.8 W/m°K | 2 | 56 148 | 2.8 GPa | -40°C |

## For inorganic substrates including Cu, Pd, Ag & Au plating, ceramic, and black oxide

| Materials | Description/Application | Resin | Filler | Recommended Cure | Viscosity 5rpm@ 25°C | Thermal Conductivity | Tg* (°C) | CTE α1/α2 | Modulus @ 25°C | Storage Temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| QMI 519 | **JEDEC L1 260C for SOIC, QFN** De facto industry standard for QFN packages. Good for all preplated leadframes and bare copper. Higher adhesion, excellent electrical and thermal performance | BMI | Silver | 15 min. @ 185°C Oven 10 secs. @ 200°C SC | 9000 cps | 3.8 W/m°K | 75 | 40 140 | 5.3 GPa | -40°C |
| NEW QMI 519HT02 | **High Thermal Conductivity** Very high electrical and thermal conductivity while maintaining excellent adhesion. Suitable for high heat dissipating devices. | BMI | Silver | 15 min. @ 185°C Oven 10 secs. @ 200°C SC | 18800 cps | 7.3 W/m°K | 49 | 42 104 | 6.70 GPa | -40°C |
| QMI 505MT | **For Pd, Alloy 42, Au and Black Oxide** Similar to QMI 519 but with superior adhesion to palladium, alloy 42, gold and black oxide finishes | BMI | Silver | 15 min. @ 185°C Oven 10 secs. @ 200°C SC | 12100 cps | 2.0 W/m°K | 10 | 72 170 | 0.86 GPa | -40°C |
| QMI 518 | **Electrically Conductive, Large Die** Similar properties to QMI 519, but formulated to have a low modulus to reduce stress on die larger than 500 x 500 mil/13x13 µm | BMI | Silver | 15 min. @ 180°C Oven 10 secs. @ 200°C SC | 8500 cps | 1.4 W/m°K | -64 | 69 152 | 0.10 GPa | -40°C |
| QMI 534 | **Non-Conductive, Small Die** Non-conductive, very high adhesive strength on metal substrates for die sizes less than 500 x 500 mil/13x13 µm | BMI | PTFE | 15 min. @ 175°C Oven 10 secs. @ 200°C SC | 9000 cps | 0.4 W/m°K | 35 | 87 171 | 0.30 GPa | -40°C |
| QMI 538 | **Non-Conductive, Large Die** Non-conductive, very high adhesive strength on metal substrates for die sizes greater than 500 x 500 mil/13x13 µm | BMI | PTFE | 15 min. @ 175°C Oven 10 secs. @ 200°C SC | 8500 cps | 0.3 W/m°K | -70 | 85 149 | 0.10 GPa | -40°C |
| QMI 536UV | **UV Cure - CCD/CMOS Glass Lid Sealing** Non-conductive, UV curing resin with excellent adhesion to glass. Ideal for glass lid-sealing CCD or CMOS lenses | BMI | PTFE | 1 min. @ 100mW/cm2 | 6700 cps | 0.3 W/m°K | 26 | 62 136 | 0.7 GPa | -40°C |
| QMI 282HT | **Non-conductive, Ultra Low Stress** Very low modulus silicone with good thermal properties for low stress, high temperature applications. | Silicone | Alumina & Zinc Oxide | 30 min. @ 150°C or 1hr. @ 120°C (No SkipCure) | 49400 cps | 1.0 W/m°K | -40 | N/A 104 | 0.004 GPa | 5°C+/-3°C |
| K00125 | **General Purpose Silver Epoxy** Silver-filled epoxy for general bonding purposes that require electrical and thermal conductivity. | Epoxy | Silver | 10 min. @ 165°C (No SkipCure) | 9200 cps | 2.1 W/m°K | 96 | 65 130 | 4.0 GPa | -40°C |

# Hysol® Die Attach Adhesives for Hermetic Packages

| Materials | Description/Application | Resin | Filler | Recommended Cure | Viscosity 5rpm@ 25°C | Thermal Conductivity | Tg* (°C) | CTE α1/α2 | Modulus @ 25°C | Storage Temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| QMI 301 | **Solder and seamed sealed packages.** Low temperature cure material with very high adhesion and >340°C temperature resistance for solder-sealed hermetic packages. | Cyanate Ester | Silver | 10 min @ 150°C | 11400 cps | 1.9 W/m°K | 245 | 45<br>85 | 6.9 GPa | 40°C |
| QMI 2419 | **No-dry Ag glass die attach for glass-sealed packages.** Very high thermal conductivity and >450°C temperature resistance. | Glass/Solvent | Silver | See ramp profile<br>7-10 min @<br>420-460°C | 37500 cps | >60 W/m°K | 300 | 21<br>N/A | 15.1 GPa | RT on Rollers |
| QMI 2569 | **No-dry Ag glass die attach for glass, solder, and seamed sealed-packages.** Very high thermal conductivity and applications for die as large as 0.800 square. | Glass/Solvent | Silver | See ramp profile<br>7-10 min @<br>360-440°C | 35800 cps | >60 W/m°K | 250 | 16<br>N/A | 15.1 GPa | RT on Rollers |
| QMI 3555R | **No-dry Ag glass die attach for glass, solder, and seamed sealed-packages.** Very high thermal conductivity and >450°C temperature resistance for glass-sealed hermetic packages. | Glass/Solvent | Silver | See Ramp Profile<br>7-10 min@<br>300-450°C | 40000 cps | >80 W/m°K | 150 | 16<br>N/A | 11.5 GPa | RT on Rollers |

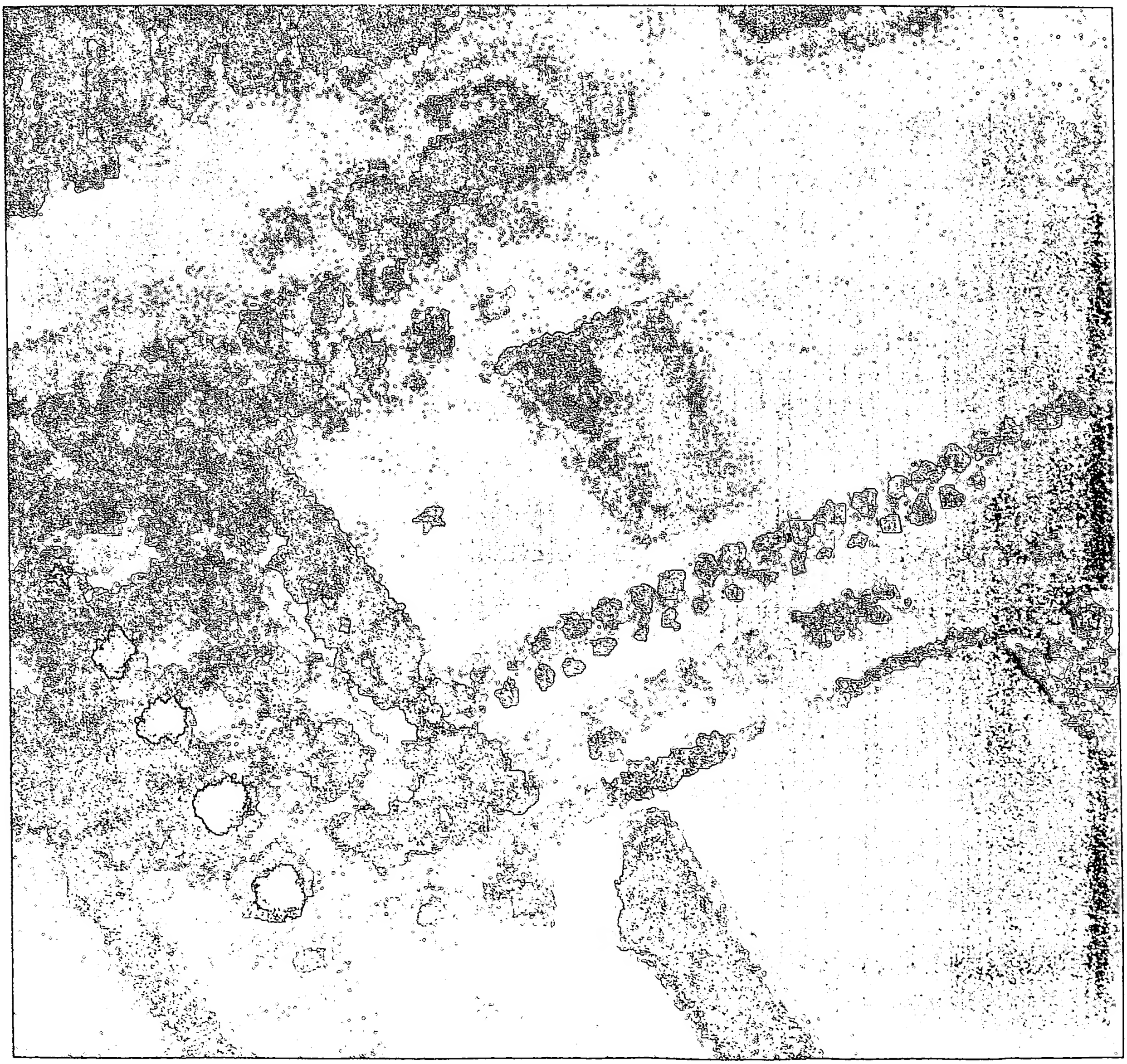



*All Hysol® QMI 500 series die attach adhesives use free radical cure, enabling extremely fast cure rates (Fig.1). Adhesives in this series cure in seconds at the appropriate temperature, instead of minutes or hours. This feature allows the adhesives to be cured in-line right on the diebonder, immediately after the substrate is indexed onto the post-bond cure station or on the wirebonder preheater. This enables high UPH which translates to low total cost-of-use. SkipCure also improves the quality of the cured part. Because the substrate is held down flat during die attach cure, the resulting substrate warpage is much lower than on oven-cured substrates. Furthermore, the short distance between bondsite and post-bond cure station minimizes adhesive slump and die movement before cure, allowing more consistent bondline thickness.*

Shin-Etsu

**Shin-Etsu Liquid Coating Materials for Electronic Devices**

# KJR Series & SEMICOAT Series

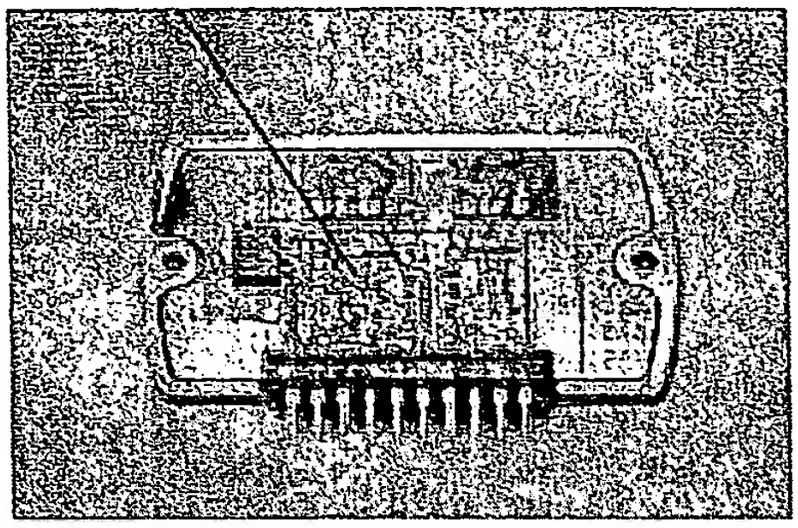


# KJR Series

## Junction Coating Resins
## Liquid Type Silicone & Polyimide Silicone for Electronic, Electric and Optical Devices

### Main Features

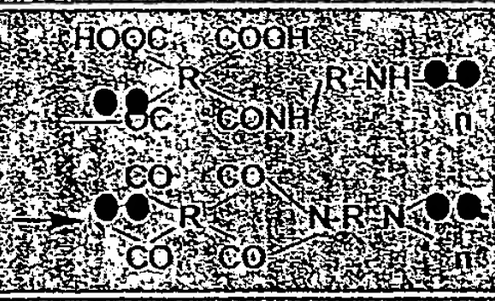
- Ultra High Purity
- High Thermal Stability
- High Electrical Stability
- High Mechanical Stability
- Excellent Adhesive Strength



## Classification of KJR Series

The KJR Series can be classified into three categories according to the chemical curing mechanism used. The manufacturing process or some characteristic of the devices to be coated may dictate which group you select for particular application.

## Chemical Curing Mechanisms

| Type | Curing Condition | Chemical Mechanism | By-Product | Grade |
|---|---|---|---|---|
| Rigid | Heat Condensation |  | $H_2O$ | KJR650E Series Polyimide Silicone |
| Flexible | Moisture Condensation | $\equiv SiOR + H_2O \rightarrow \equiv SiOH + ROH$<br>$\equiv SiOR + HOSi \equiv \rightarrow \equiv SiOSi \equiv + ROH$ | ROH | KJR4000E Series Silicone |
| Flexible Gel | Heat Addition | $\equiv SiCH + CH_2 + HSi \equiv \rightarrow \equiv SiCH_2CHSi \equiv$ | None | KJR9000E Series Silicone |

### Rigid Type

After curing, this coating film hardens to a highly rigid polyimide.
Since it is also has excellent adhesive properties, it is ideal for coating of particularly high voltage resistant devices.

### Flexible Type

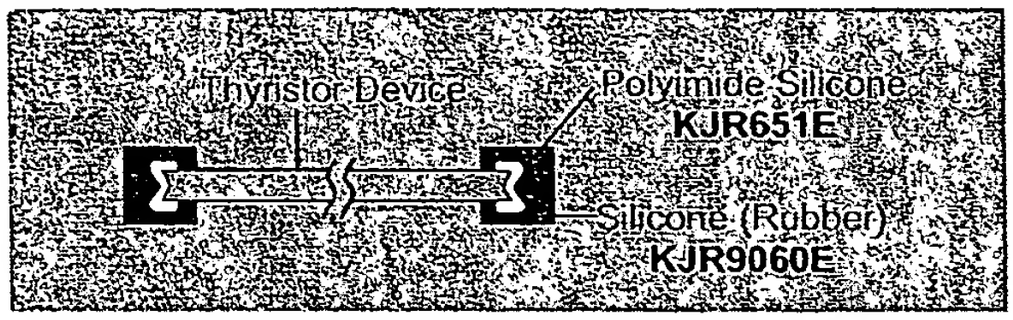
After curing, this coating film has outstanding rubber elastic properties.
By absorbing stress due to external forces, it can prevent fracturing of devices or breakage of bonding wires.

### Gel Type

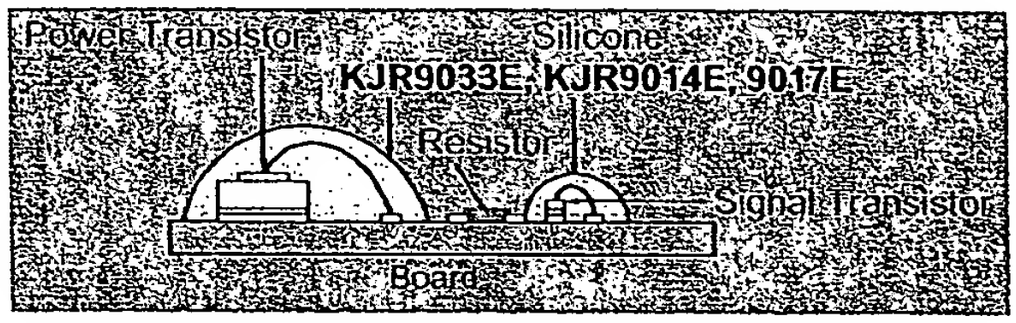
After curing, this coating film is a soft gel type of material.
It has extremely low stress compared with the rubber type, so maximum buffer effect can be achieved.
Since it has superb adhesion strength and lead sealing, it can provide the best humidity protection.

## Typical Application of KJR Series for Various Devices

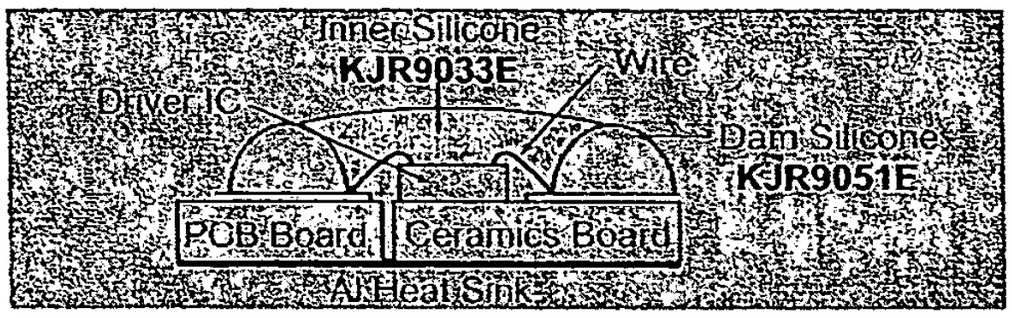
• a• GTO Thyristor Coating



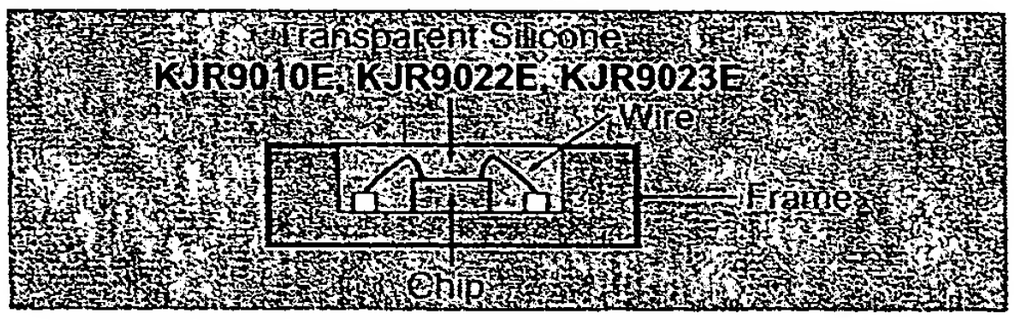

• b• Hybrid IC Chip Coating



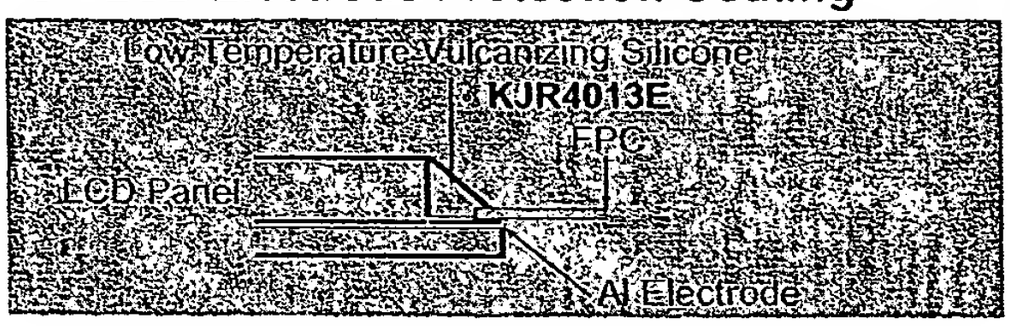

• c• Thermal Head Coating




• d• Photo Diode Coating




• e• LCD Electrode Protection Coating




## Curing KJR Series Resins

The KJR Series resins maintain primarily two types of curing schedules• heat curable, and moisture curable. The heat curable type material requires a heat cure of 150• •to 170• •for one to four hours. Our moisture cure material requires more than 40 percent relative humidity for 24 hours at room temperature.

In most cases, post-curing is also required to obtain optimum properties with the greatest resistance to temperature extremes and improved reliability of coated devices.

Several of the KJR-9010E Series will remain in a gel state and do not require post-curing.

| Type | Product Name | Cure Condition | Post Cure Condition |
|---|---|---|---|
| Flexible | 9051E 9052E | 80• 100• /1• 4Hr | 200• /4• 16Hr |
| | 9022E 9023E 9050E | 100• 150• /1• 4Hr | 200• /4• 16Hr |
| | 9033E 9060E 9061E | 150• 170• /1• 4Hr | 200• /4• 16Hr |
| | 4010E 4013E 4012E 4050E | 20• 25• /45• 65• RHD/24Hr • 150• /1• 4Hr | 200• /4• 16Hr |
| Gel | 9010E 9015E | 100• 150• /1• 4Hr | 200• /4• 16Hr |
| | 9014E 9017E | 150• 170• /1• 4Hr | 200• /4• 16Hr |
| Rigid | 651E 654E | 150• /1Hr• 200• /1Hr• 250• /4Hr | 300• /0.5• 4Hr |
| | 653E | 150• /1Hr• 200• /16Hr | 250• /0.5• 4Hr |

# KJR Series

## Reduced Impurities, Higher Stability for Superior Semiconductors

### Impurity

**Very Low Ionic Impurity Reduces Risk of Corrosion**

KJR Series resins are extremely pure, offering superior stability to all types of semiconductor devices. The most critical impurity, chloride ion, is kept to an absolute minimum, greatly reducing the risk of electrode corrosion.

**Ionic Impurities** ppm

| Grade \ Ion | Na | K | Cl |
|---|---|---|---|
| KJR Series | 0.1 | 0.2 | 1.0 |
| General Silicone | 0.5 | 5 | 5 - 10 |

**Low Uranium Content for Alpha Particle Sensitive Devices**

The low uranium content of KJR Series resins is an important feature in improving the performance of devices.

**Content of Uranium** ppb

| Product | Uranium Content |
|---|---|
| KJR Series | Undetective |
| KJR651E | Undetective |
| Synthetic Quartz | 1 - 10 |
| Natural Quartz | 30 - 80 |

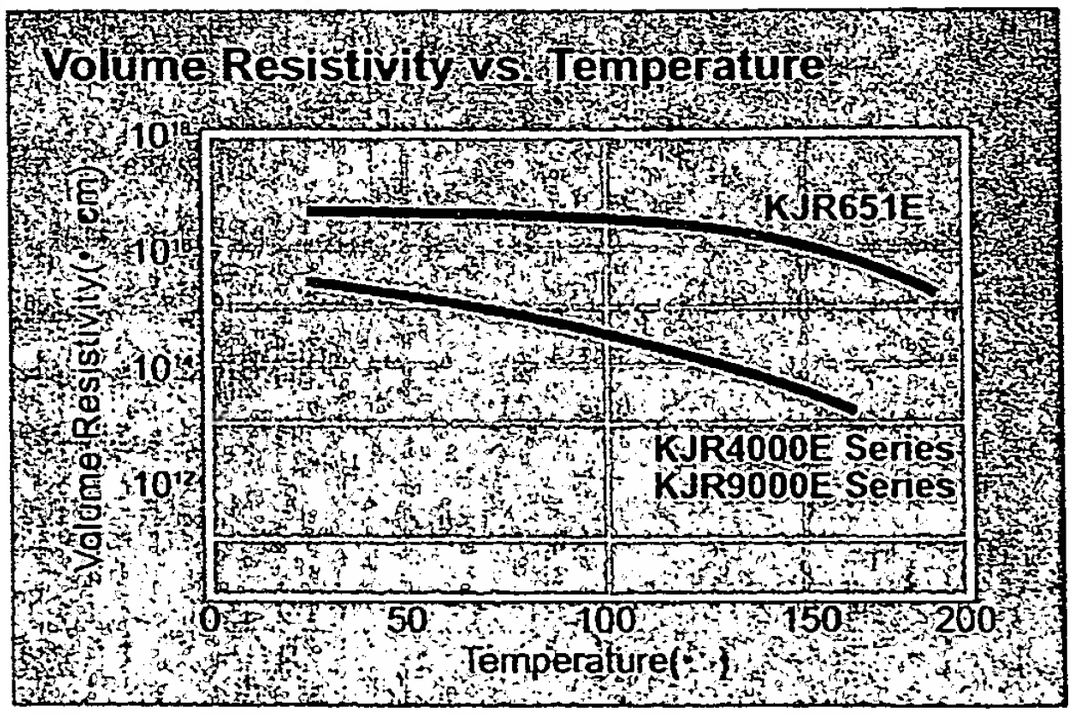
fluorometric Method

### Electrical Stability

**Electrical Stability over a Broad Temperature Range**

At high and low temperature extremes, KJR Series resins maintain electrical stability, due to the combination of basic organo-siloxane bonding and the low content of ionic impurities. The result is a more reliable device that operates safely in a wide variety of conditions, even at very high temperatures.

The KJR651E, a copolymer structure composed of polyimide and polysiloxane, possesses superior high temperature properties.

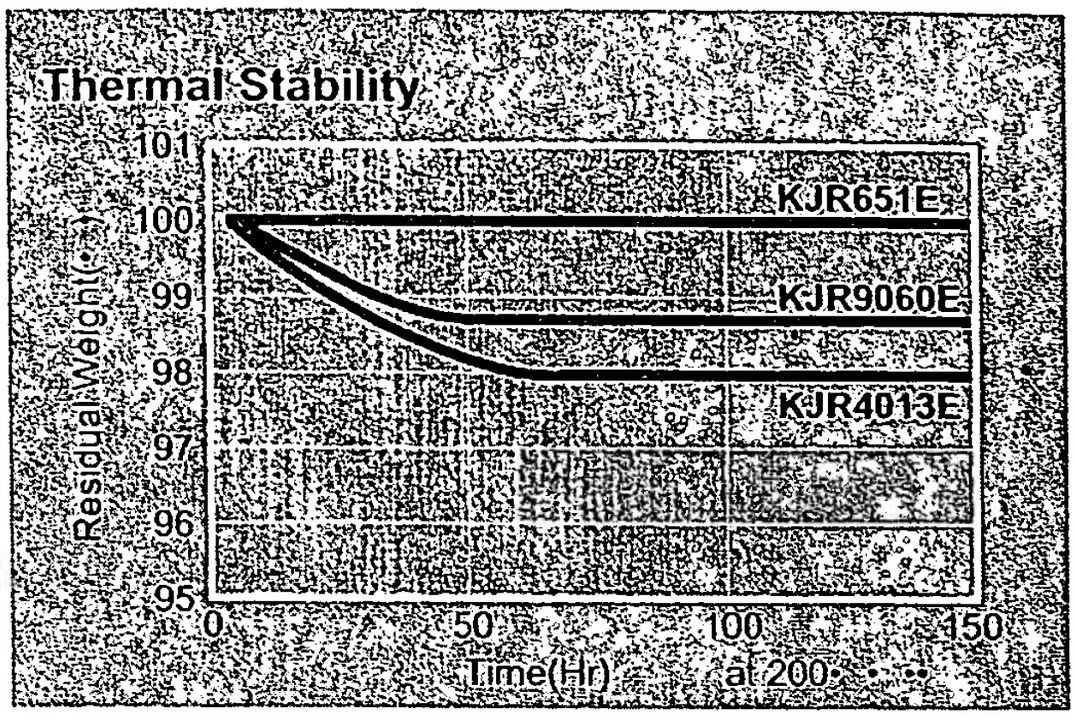


## Thermal Stability

### Thermal Stability Protects Against Extremes

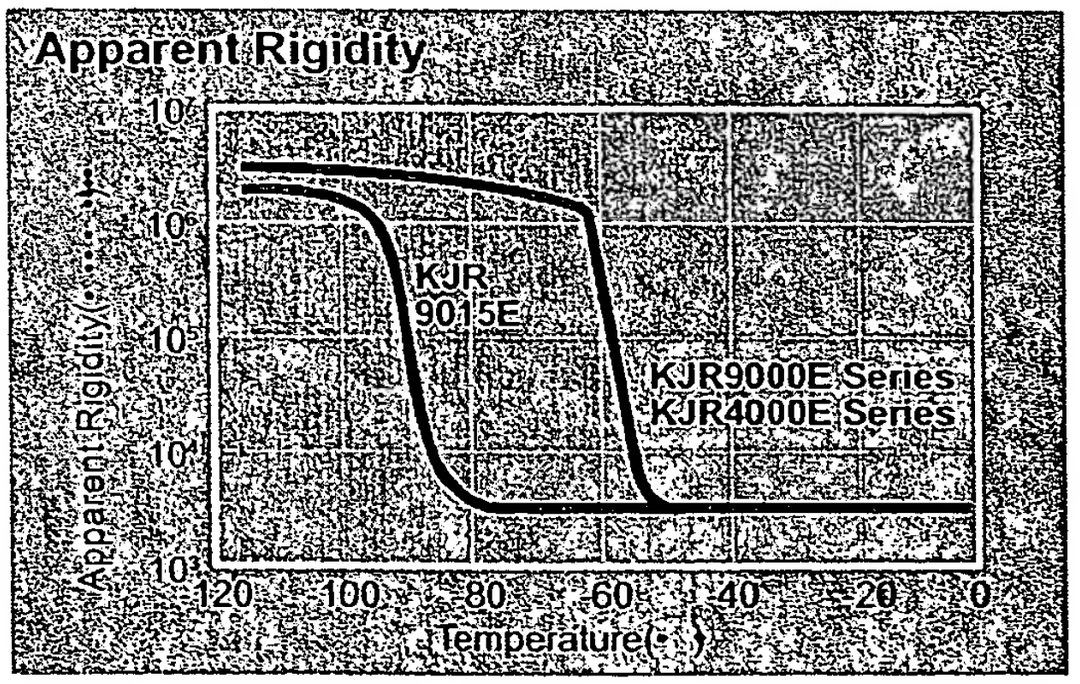
Thermal stability derived from the inherent properties of silicones gives the KJR Series the ability to protect devices from the extremes of heat shock, solder dip and other situations.

The KJR651E with its special copolymer structure is the most stable, capable of withstanding temperatures as high as 250• :




### Flexibility Down to • 80• •

KJR9015E maintains its flexibility at temperatures as low as • 80• ; providing an effective buffer against severe thermal shock.




## Adhesive Property

### Improved Breakdown Voltages with Higher Adhesive Strength

The KJR Series shows a very good affinity for the metallic and ceramic substrates used in semiconductor manufacturing. Higher breakdown voltages and lower leak currents result from the bonding properties of the KJR Series.

Post-curing is recommended to further improve the adhesive strength and stability of KJR Series resins.

• 1 Shear Strength kg/cm²• •

• 2 Area of JCR remaining on substrate after Shear Test percent• . •

**Adhesive Strength**

| | | Silicon Substrate | | Aluminum Substrate | |
|---|---|---|---|---|---|
| | GRADE | Strength 1 | Residual Area 2 | Strength 1 | Residual Area 2 |
| Flexible Type | 4010E | 3 | 100 | 3 | 100 |
| | 4012E | 3 | 100 | 3 | 100 |
| | 4013E | 8 | 100 | 8 | 100 |
| | 4050E | 4 | 100 | 4 | 90 |
| | 9010E | • • | 100 | • • | 100 |
| | 9014E | • • | 100 | • • | 100 |
| | 9015E | • • | 100 | • • | 100 |
| | 9022E | 8 | 100 | 8 | 100 |
| | 9023E | 2 | 100 | 2 | 100 |
| | 9033E | 3 | 100 | 3 | 100 |
| | 9050E | 4 | 100 | 6 | 100 |
| | 9051E | 6 | 100 | 6 | 100 |
| | 9052E | 3 | 100 | 3 | 100 |
| | 9060E | 10 | 100 | 10 | 100 |
| | 9061E | 10 | 100 | 10 | 100 |

# KJR Series

## General Properties

| Type | | Rigid Type | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Item / Product Name / Unit | | KJR651E | KJR653E | KJR654E | KJR4010E | KJR4012E | KJR4013E | KJR4050E | KJR9022E |
| Component | | One | One | One | One | One | One | One | Two |
| Polymerization | | Thermoset | Thermoset | Thermoset | Moisture cure | Moisture cure | Moisture cure | Moisture cure | Thermoset |
| Appearance | | Brown | Brown | Brown | White | Translucent | White | Translucent | Transparent |
| Non volatile part | | 25 | 24 | 19 | 100 | 100 | 100 | 100 | 100 |
| Solvent | | N-Methyl-2-pyrrolidone | N-Methyl-2-pyrrolidone | Xylene N-Methyl-2-pyrrolidone | None | None | None | None | None |
| Viscosity 25 | Poise | 20 | 23 | 4 | 30 | 30 | 55 | 350 | 40 |
| Shelf Life 5 | Month | 3 | 3 | 3 | 6 | 6 | 6 | 6 | 6 |
| Mixing Ration | Base/cure agent | | | | | | | | 100/10 |
| Pot Life 25 | Hr | | | | | | | | 10 |
| Tack Free Time 25 | Hr | | | | | | 2 | 1 | |
| Cure Condition | Hr | 150/1 200/1 250/4 | 150/1 200/16 | 150/1 200/1 250/4 | 25/24 150/4 | 25/21 150/4 | 25/24 150/4 | 25/24 150/4 | 150/4 |
| Specific gravity | | | | | 1.05 | 1.05 | 1.26 | 1.05 | 1.01 |
| Hardness | Shore | 80 D | 80 D | 80 D | 22 A | 20 A | 38 A | 18 A | 42 A |
| Tensile Strength | kg/cm² | 1,400 | 800 | 1,400 | 15 | 12 | 20 | 17 | 50 |
| Elongation | % | 80 | | | 200 | 200 | 150 | 300 | 150 |
| Adhesive Strength Silicon | kg/cm² | | | | 3 100 | 3 100 | 8 100 | 4 100 | 8 100 |
| Adhesive Strength Aluminum | kg/cm² | | | | 3 90 | 3 80 | 8 100 | 4 90 | 8 100 |
| Volume Resistivity | Ω cm | 1×10¹⁶ | 1×10¹⁶ | 1×10¹⁶ | 1×10¹⁶ | 1×10¹⁶ | 1×10¹⁶ | 1×10¹⁶ | 5×10¹⁵ |
| Dielectric Strength | kV/mm | 13 0.1mm | 10 0.1mm | 13 0.1mm | 24 | 22 | 25 | 23 | 25 |
| Dielectric Constant | 50Hz | 3.1 | 3.1 | 3.1 | 3.0 | 3.0 | 3.3 | 3.0 | 2.9 |
| Dissipation Factor | 50Hz | 3.1×10⁻² | 3.2×10⁻² | 3.1×10⁻² | 5×10⁻² | 5×10⁻² | 3×10⁻² | 5×10⁻² | 5×10⁻² |
| Applicable Temperature | | -50~+200 | -50~+200 | -50~+200 | -50~+200 | -50~+200 | -50~+200 | -50~+200 | -50~+200 |
| Application | | | | | | | | | |
| Diode | | | | | | | | | |
| Rectifier | | | | | | | | | |
| Thyristor | | | | | | | | | |
| Transistor | | | | | | | | | |
| Opto Coupler | | | | | | | | | |
| L.E.D. | | | | | | | | | |
| LCD | | | | | | | | | |
| Integrated Circuit | | | | | | | | | |
| Hybrid IC | | | | | | | | | |

• • • •More than 60• •Relative Humidity • • ⁻ Penetration Measure

| Flexible Type | | | | | | | | Gel Type | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| KJR9023E | KJR9025E | KJR9033E | KJR9060E | KJR9061E | KJR9050E | KJR9051E | KJR9052E | KJR9010E | KJR9014E | KJR9015E | KJR9017E |
| Two | Two | One | One | One | Two | Two | Two | Two | One | Two | One |
| Thermoset | Thermoset | Thermoset | Thermoset | Thermoset | Thermoset | Thermoset | Thermoset | Thermoset | Thermoset | Thermoset | Thermoset |
| Transparent | Translucent | While | Translucent | Translucent | Black | Gray | Translucent | Transparent | Translucent | Transparent | Transparent |
| 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| None | None | None | None | None | None | None | None | None | None | None | None |
| 40 | 70 | 50 | 90 | 170 | 300 | 50 | 90 | 7 | 100 | 8 | 8 |
| 6 | 6 | 3 | 3 | 3 | 6 | 6 | 6 | 6 | 3 | 6 | 3 |
| 100/10 | 100/100 | - | - | - | 100/10 | 100/10 | 100/10 | 100/10 | - | 100/100 | - |
| 24 | 24 | - | - | - | 24 | 24 | 24 | 8 | - | 8 | - |
| - | - | - | - | - | - | - | - | - | - | - | - |
| 150/4 | 80/2 | 150/4 | 150/4 | 150/4 | 150/4 | 80/2 | 80/2 | 150/2 | 150/2 | 150/2 | 150/2 |
| 0.99 | 1.00 | 1.0 | 1.0 | 1.0 | 1.04 | 1.18 | 1.00 | 0.97 | 1.00 | 0.99 | 0.99 |
| 22 A | 17 A | 20 A | 10 A | 13 A | 35 A | 41 A | 16 A | 65 | 65 | 65 | 65 |
| 7 | 5 | 5 | 16 | - | 15 | 15 | 7 | - | - | - | - |
| 150 | 200 | 150 | 600 | 600 | 180 | 150 | 180 | - | - | - | - |
| 2 100 | - | 3 100 | 10 100 | 10 100 | 4 70 | - | - | - | - | - | - |
| 2 100 | - | 3 100 | 10 100 | 10 100 | 6 100 | - | - | - | - | - | - |
| 1 10^15 | 5 10^14 | 1 10^15 | 2 10^15 | 2 10^15 | 1 10^15 | 1 10^15 | 1 10^15 | 1 10^15 | 1 10^15 | 1 10^15 | 1 10^15 |
| 23 | 21 | 21 | 24 | 23 | 25 | 28 | 22 | - | - | - | - |
| 28 | 29 | 29 | 28 | 28 | 30 | 30 | 27 | 30 | 30 | 30 | 30 |
| 5 10^4 | 5 10^4 | 4 10^4 | 4 10^4 | 5 10^4 | 5 10^4 | 3 10^4 | 2 10^4 | 4 10^4 | 4 10^4 | 4 10^4 | 4 10^4 |
| 50 200 | 50 200 | 50 200 | 50 250 | 50 250 | 50 200 | 50 200 | 50 200 | 50 200 | 50 200 | 80 250 | 80 250 |

## Inhibitors Against KJR9000E Series

Curability of grade nos. with 9000E Series will decline if catalysts lose their activity by some compounds.
Before using 9000E Series, curing equipment and containers must be washed well and take care of contamination of inhibitors as follows;

### Inhibitors

The compounds which will be the inhibitors have atoms of N, P, S, or Sn in their molecules.

N :Amines, Isocyanates, Amides, Nitriles, etc.
P :Phosphines, Phosphoxides, Phosphoric Esters, etc.
S :Mercaptans, Sulfonates, Sulfides, etc.
Sn :Organo-Tin Compounds Chlorides, Esters, etc.•, etc.

### Strength of Inhibitors

The order strength of inhibitors as above is P•· •S• •Sn, N.
Curability of 9000E Series decline if phosphor compounds are contaminated in several ppm.

### Moisture

Moisture, other than the above mentioned inhibitors, has influence upon curability of 9000E Series.
So, please use them paying attention to invasion of moisture.

## Handling KJR Series Resins

### Storage

To prolong shelf-life, store KJR Series resins in a cool, dark place such as a refrigerator•. •The seal of the bottle should be examined and kept tight to reduce the possibility of moisture or contaminants contacting the resins• • particularly with moisture-cure grade resins.

### Preparation

Stir KJR Series resins before using to prevent separation. All grades should be deaerated to minimize the risk of air bubbles in the coating. This is especially critical with the two-component variety. Deaeration should be carried out at a vacuum of less than 15mm Hg for approximately 20 minutes.
The resins should be mixed at the prescribed mix ratio, as shown in the selector guide See General Properties• . •

### Coating and Curing

During the coating process, dispense the resins mechanically with specially designed dispensing equipment, or manually by syringe. Protect the coatings from contamination due to moisture, ionic materials, and other foreign substances.
Ensure proper ventilation to remove condensation products from the curing oven.

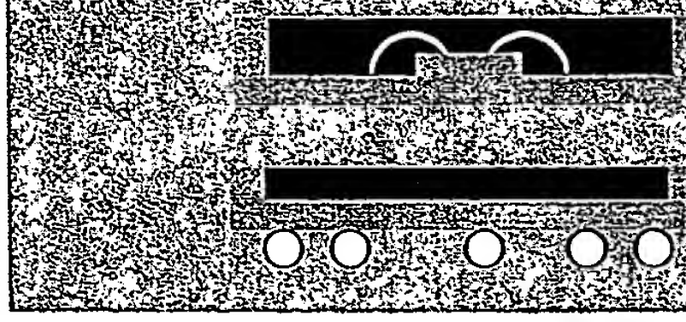
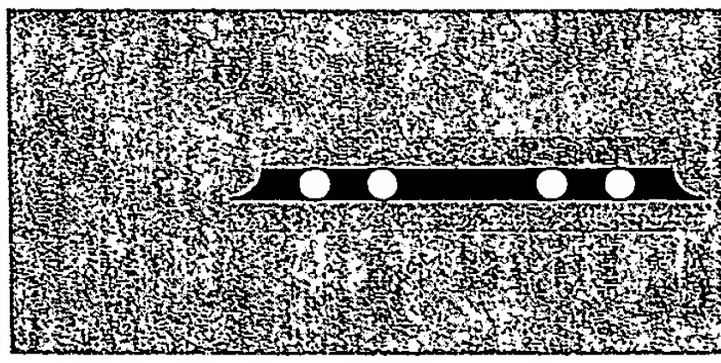
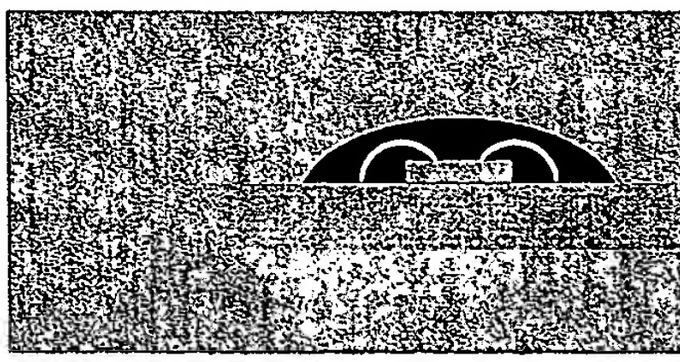
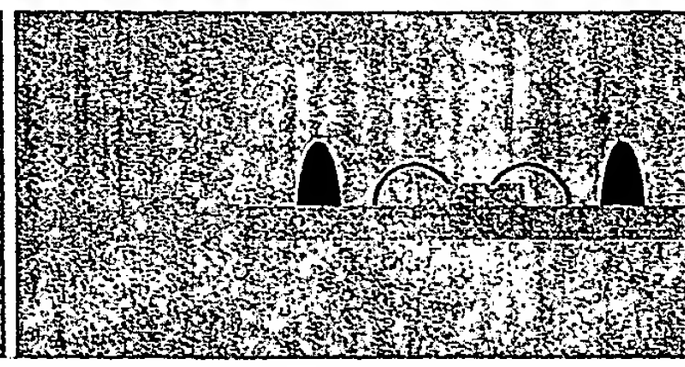
### Post-Cure

Perform post-cure at approximately 200• •for four to sixteen hours. The post-cure process is essential in improving the resins' passivation quality for all grades with the exception of gel type KJR Series.

# SEMICOAT Series

## Liquid Epoxy Coating Agents for Semiconductors
## One Component Thermosetting Type

### Typical Application of SEMICOAT Series for Semiconductors

| Application | | Product Name |
|---|---|---|
| Potting<br>for PGA, BGA etc. |  | SEMICOAT 114, SEMICOAT 115<br>X-43-5012A<br>SEMICOAT 122<br>SEMICOAT 124 |
| Underfill<br>for Flip Chip |  | X-43-5107, X-43-5107-1, X-43-5107-2<br>X-43-5123, X-43-5127 |
| Glob Top<br>for COB |  | SEMICOAT 220L, 220H, 227<br>SEMICOAT 120X-1,<br>SEMICOAT 125H |
| Dam Forming<br>Bank Agent |  | X-43-5255 |

- UL94V-0 recognized component

## Potting for PGA, BGA etc.

| Product Name | | SEMICOAT 114 | SEMICOAT 115 | X-43-5012A | SEMICOAT 122 | SEMICOAT 124 |
|---|---|---|---|---|---|---|
| Feature | | Low viscosity | Low viscosity<br>Low stress | Low stress<br>Good Adhesion | Low stress<br>Small warpage | Low stress<br>Flame resistance |
| Aspect Ratio | | 0.10 | 0.05 | 0.05 | 0.05 | 0.05 |
| ITEM | UNIT | | | | | |
| Appearance | | Black | Black | Black | Black | Black |
| Viscosity 25 | poise | 55 | 400 | 1000 | 400 | 900 |
| Gelation Time 150 | sec | 60 | 70 | 70 | 60 | 70 |
| Flexural Strength 25 | kgf/mm² | 8 | 10 | 10 | 11 | 10 |
| Flexural Modulus 25 | kgf/mm² | 450 | 1100 | 1300 | 1300 | 1000 |
| Coefficient of Thermal Expansion 1 | ppm/ | 45 | 20 | 15 | 15 | 20 |
| Thermal Expansion 2 | ppm/ | 140 | 80 | 60 | 60 | 80 |
| Glass Transition Temp | | 135 | 145 | 145 | 155 | 145 |
| Volume Resistivity at 25 | cm | 2 10¹⁶ | 2 10¹⁶ | 2 10¹⁶ | 2 10¹⁶ | 1 10¹⁶ |
| Dielectric Constant at 1kHz | | 4.0 | 3.5 | 3.3 | 3.6 | 3.5 |
| Recommended Cure Condition | | 100 /1Hr 150 /1Hr | 100 /0.5Hr 150 /2Hr | 100 /0.5Hr 150 /2Hr | 100 /1Hr 150 /2Hr | 100 /0.5Hr 150 /2Hr |
| Dispense Condition Device Temp | | 22 50 | 70 90 | 70 90 | 70 90 | 70 90 |
| Storage Condition | | Below 5 | Below 5 | Below 5 | Below 40 | Below 6 |

• to avoid trapping air in dispense process.

• 1 UL94V-0 recognized component

## Underfill for Flip Chip

| Product Name | | Special formulation | | | Standard type | |
|---|---|---|---|---|---|---|
| | | X-43-5107 | X-43-5107-1 | X-43-5107-2 | X-43-5123 | X-43-5127 |
| Feature | | High reliability<br>Good penetration | High reliability<br>Better penetration | Low viscosity<br>More better penetration | Low viscosity<br>Good penetration | Low viscosity<br>Better penetration |
| Possible Gap Size | m | 20 100 | 20 100 | 20 100 | 40 400 | 20 100 |
| ITEM | UNIT | | | | | |
| Appearance | | Black | Black | Black | Black | Black |
| Viscosity 25 | poise | 2500 | 1000 | 360 | 150 | 80 |
| Viscosity 100 | poise | 7.8 | 3.5 | 1.8 | 2.0 | 1.5 |
| Gelation Time 150 | sec | 330 | 330 | 330 | 75 | 75 |
| Flexural Strength 25 | kgf/mm² | 10 | 10 | 10 | 10 | 10 |
| Flexural Modulus 25 | kgf/mm² | 800 | 700 | 600 | 650 | 650 |
| Coefficient of Thermal Expansion 1 | ppm/ | 27 | 32 | 38 | 32 | 32 |
| Thermal Expansion 2 | ppm/ | 80 | 91 | 98 | 105 | 105 |
| Glass Transition Temp | | 140 | 140 | 140 | 145 | 145 |
| Volume Resistivity at 25 | cm | 1 10¹⁶ | 1 10¹⁶ | 1 10¹⁶ | 1 10¹⁶ | 1 10¹⁶ |
| Dielectric Constant at 1kHz | | 3.8 | 3.8 | 3.8 | 3.5 | 3.5 |
| Recommended Cure Condition | | 120 0.5 Hr + 150 2Hr | | | 100 0.5 Hr + 150 2Hr | |
| Dispense Condition Device Temp | | 110 130 | | | 80 100 | |
| Storage Condition | | Below 5 | | | Below 5 | |



• 1 UL94V-0 recognized component

## Glob Top for COB(thixotropic type)

| Product Name | | SEMICOAT 220L | SEMICOAT 220H | SEMICOAT 227 | SEMICOAT 120X-1 | SEMICOAT 125H |
|---|---|---|---|---|---|---|
| Feature | | Low thixotropy | Middle thixotropy | High thixotropy | Low stress Middle thixotropy | Flame resistance Middle thixotropy |
| Aspect Ratio *1 | | 0.14 | 0.20 | 0.28 | 0.18 | 0.24 |
| ITEM | UNIT | | | | | |
| Appearance | | Black | Black | Black | Black | Black |
| Viscosity 25 | poise | 850 | 900 | 1000 | 1100 | 900 |
| Gelation Time 150 | sec | 70 | 70 | 70 | 65 | 70 |
| Flexural Strength 25 | kgf/mm² | 10 | 10 | 10 | 10 | 8 |
| Flexural Modulus 25 | kgf/mm² | 800 | 800 | 800 | 1200 | 850 |
| Coefficient of Thermal Expansion 1 | ppm/ | 24 | 24 | 24 | 15 | 24 |
| Coefficient of Thermal Expansion 2 | ppm/ | 95 | 95 | 95 | 60 | 95 |
| Glass Transition Temp | | 140 | 140 | 140 | 150 | 145 |
| Volume Resistivity at 25 | cm | 2 10 | 2 10 | 2 10 | 2 10 | 1 10 |
| Dielectric Constant at 1kHz | | 3.5 | 3.5 | 3.5 | 3.6 | 3.5 |
| Recommended Cure Condition | | 100 /0.5Hr 150 /2Hr | 100 /0.5Hr 150 /2Hr | 100 /0.5Hr 150 /2Hr | 100 /1Hr 150 /2Hr | 100 /0.5Hr 150 /2Hr |
| Dispense Condition Device Temp | | 60 80 | 60 80 | 60 80 | 60 80 | 60 80 |
| Storage Condition | | Below 5 | Below 5 | Below 5 | Below 40 | Below 5 |

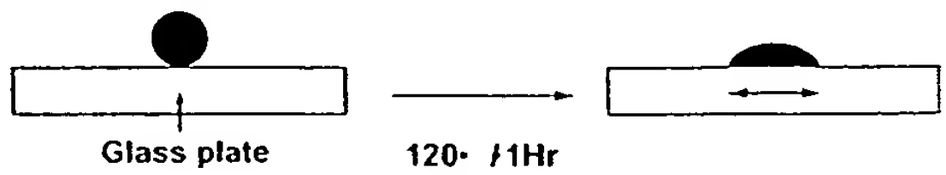
*1 UL94V-0 recognized component

## Dam Forming

| Product Name | | X-43-5255 |
|---|---|---|
| Feature | | High thixotropy Good shape retention |
| Aspect Ratio | | 0.75 |
| ITEM | UNIT | |
| Appearance | | Black |
| Viscosity 25 | poise | 7000 |
| Gelation Time 150 | sec | 70 |
| Flexural Strength 25 | kgf/mm² | 10 |
| Flexural Modulus 25 | kgf/mm² | 8000 |
| Coefficient of Thermal Expansion 1 | ppm/ | 25 |
| Coefficient of Thermal Expansion 2 | ppm/ | 95 |
| Glass Transition Temp | | 140 |
| Volume Resistivity at 25 | cm | 2 10 |
| Dielectric Constant at 1kHz | | 3.5 |
| Recommended Cure Condition | | 100 /0.5Hr 150 /2Hr |
| Dispense Condition Device Temp | | 22 50 |
| Storage Condition | | Below 5 |

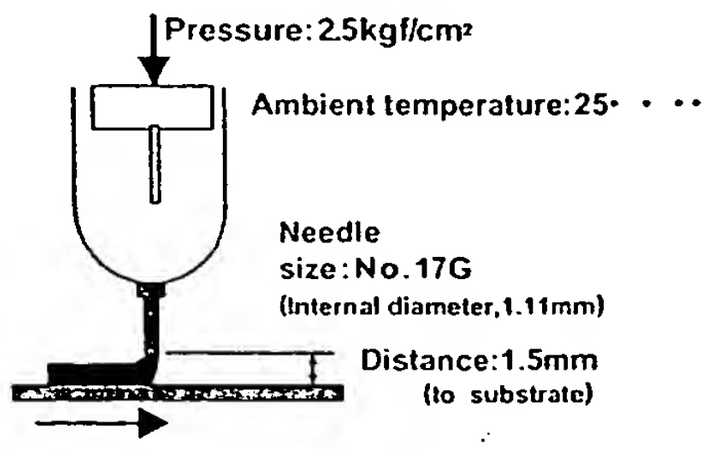
*2 **Measurement Method**

0.1 g sample dropped




Aspect Ratio = Height / Width

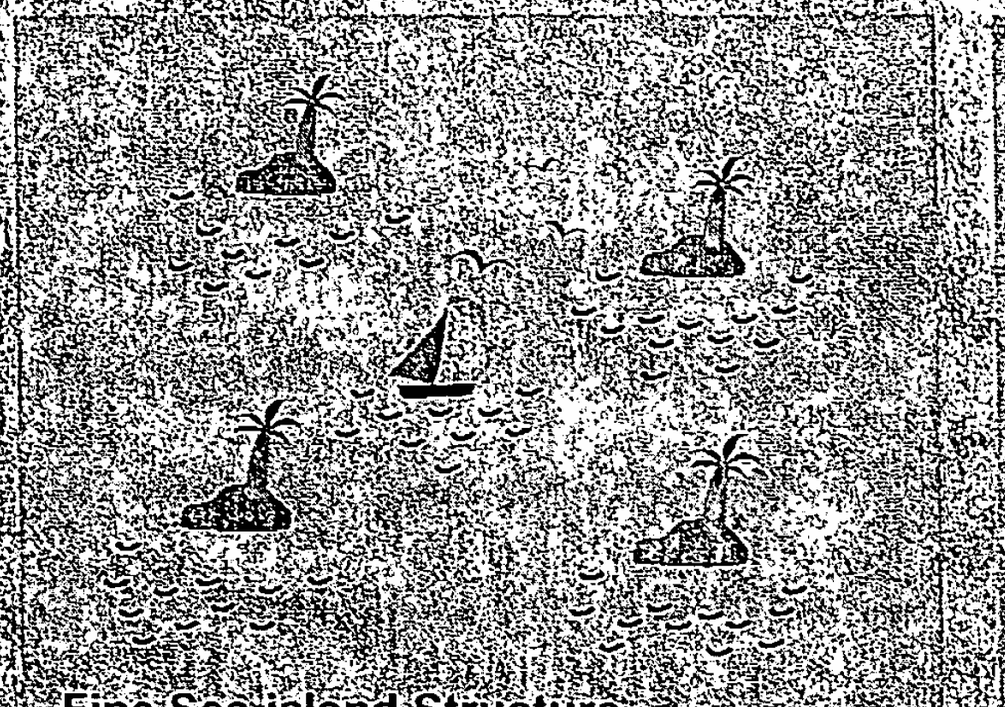
*3




Aspect Ratio = Height / Width

## Distinction of SEMICOAT• • •Low Stress Performance

Security as great as the number of islands in the sea• • ••
This is the Shin-Etsu fine sea-island structure

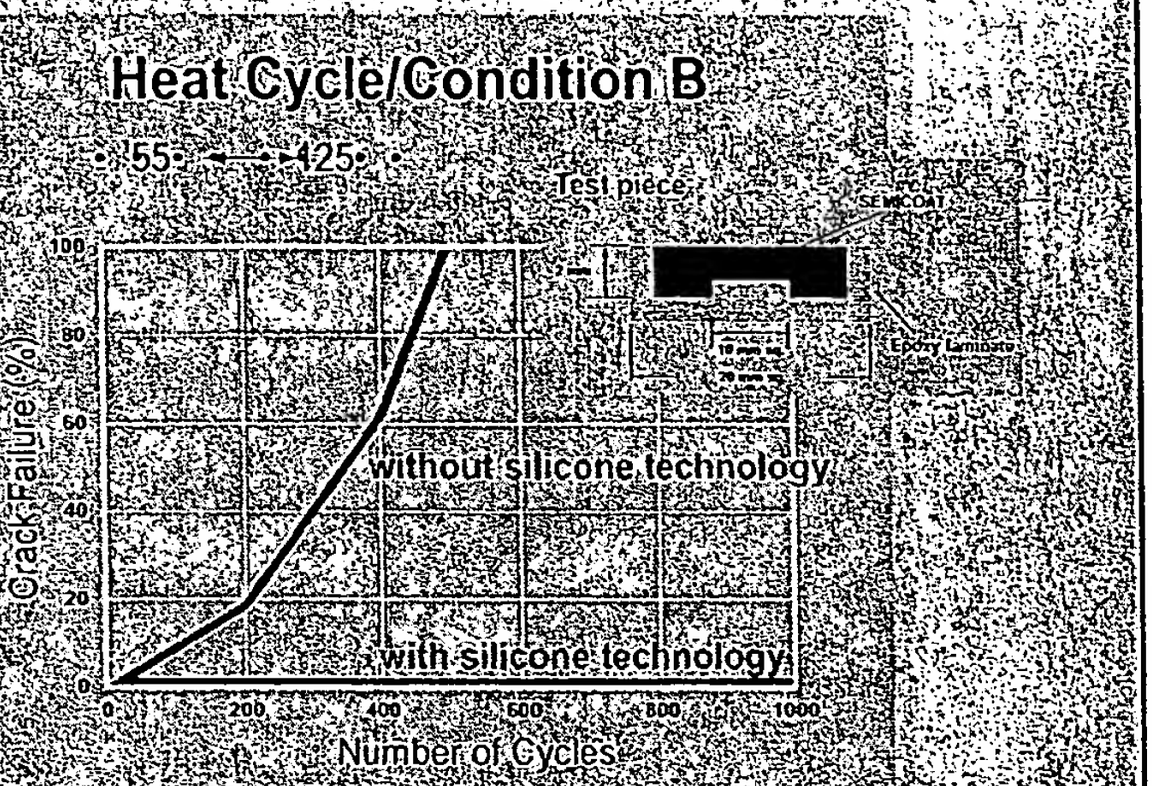


**Fine Sea-island Structure**

Fine sea-island structure means, just like islands in the sea, silicone is dispersed equally in epoxy resin.
If there is distortion, that silicone islands will absorb it.

**Heat Cycle/Condition B**

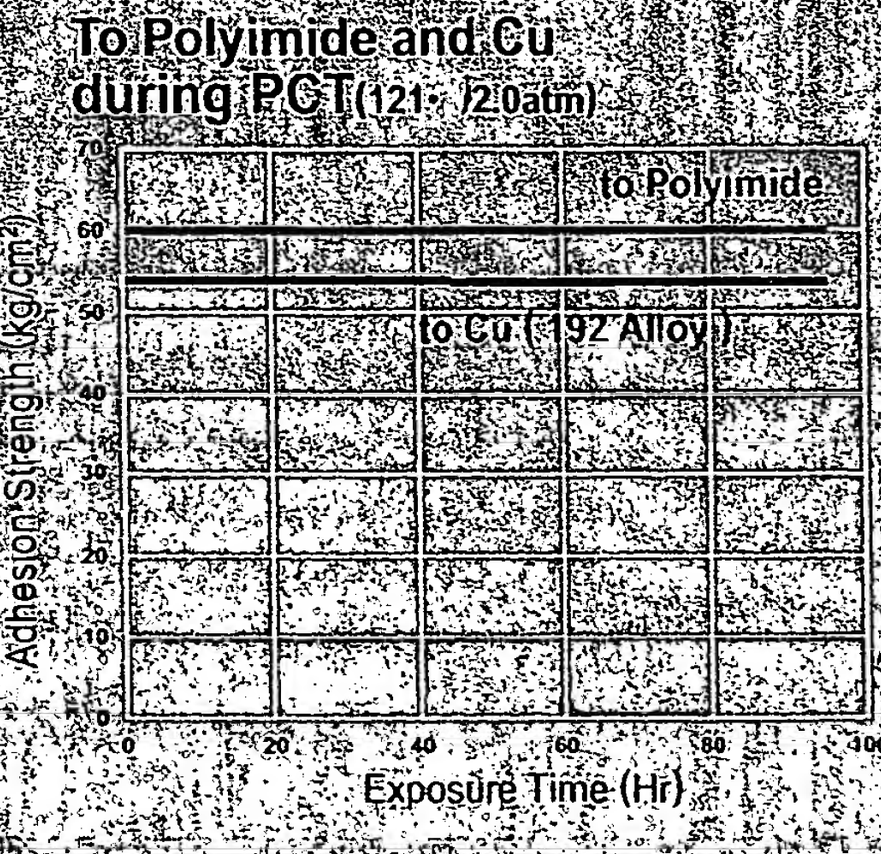
-55• ~ +125• •




## Potting

**X-43-5012A** **Excellent Adhesion Property (Less Sensitivity to Moisture)**

**To Polyimide and Cu during PCT(121• /2 0atm)**

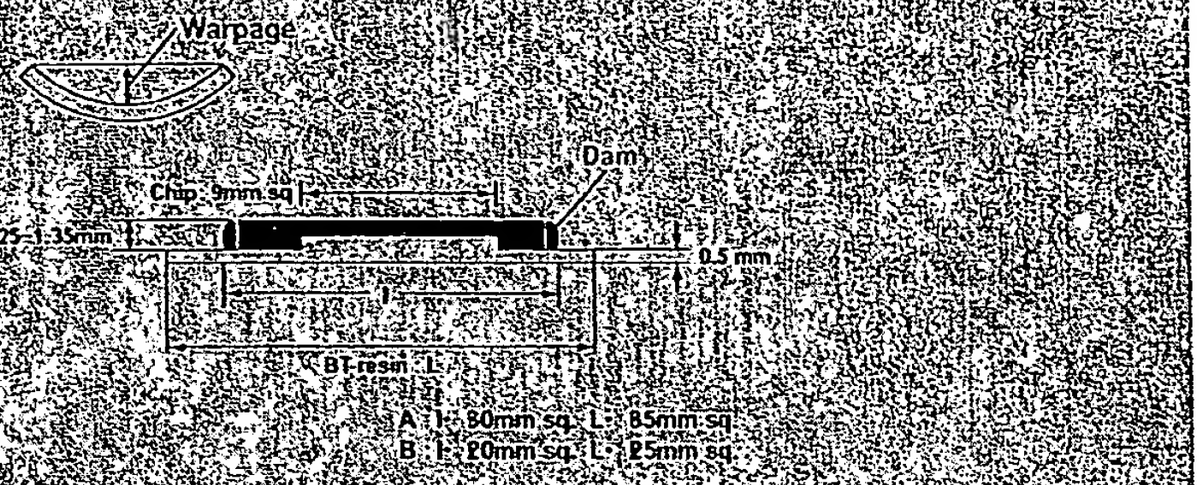



**Moisture Absorption (PCT,121• )**


# SEMICOAT 122

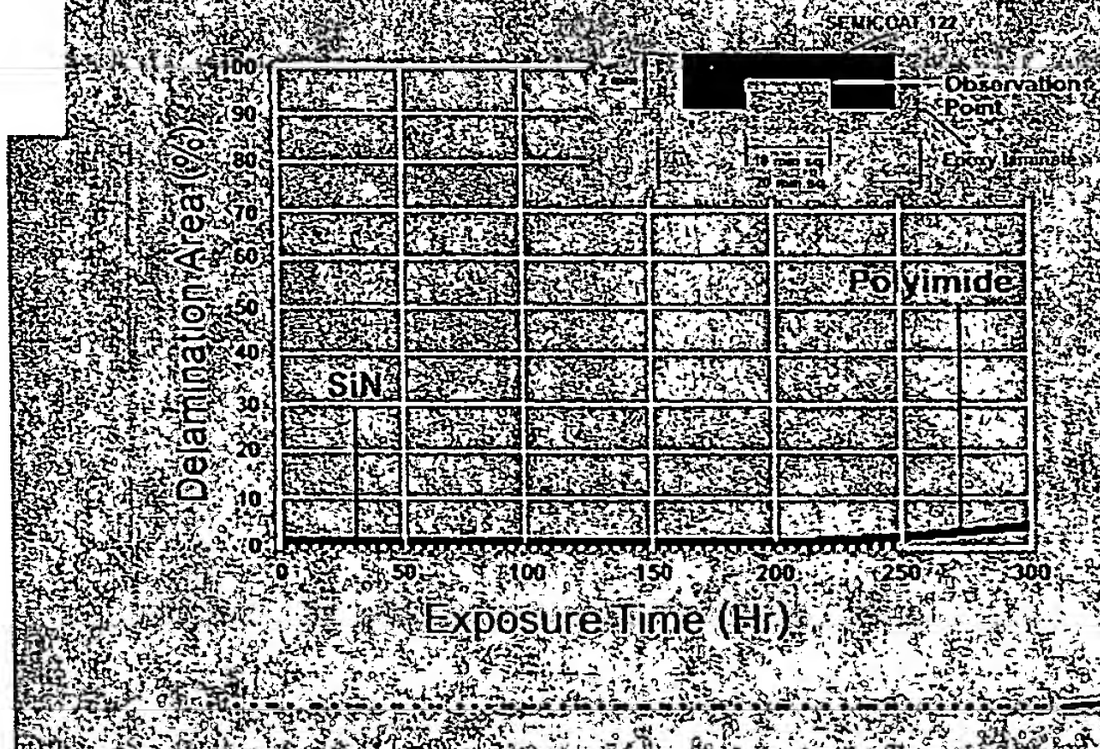
## Small Warpage

| Test Device | Cure Condition | Warpage (μm) |
|---|---|---|
| A | 100℃/1Hr+150℃/2Hr | 150 |
| A | 90℃/3Hr+150℃/2Hr | 60 |
| B | 90℃/3Hr+150℃/2Hr | 30 |




## Good Adhesion to Organic and Inorganic Layer

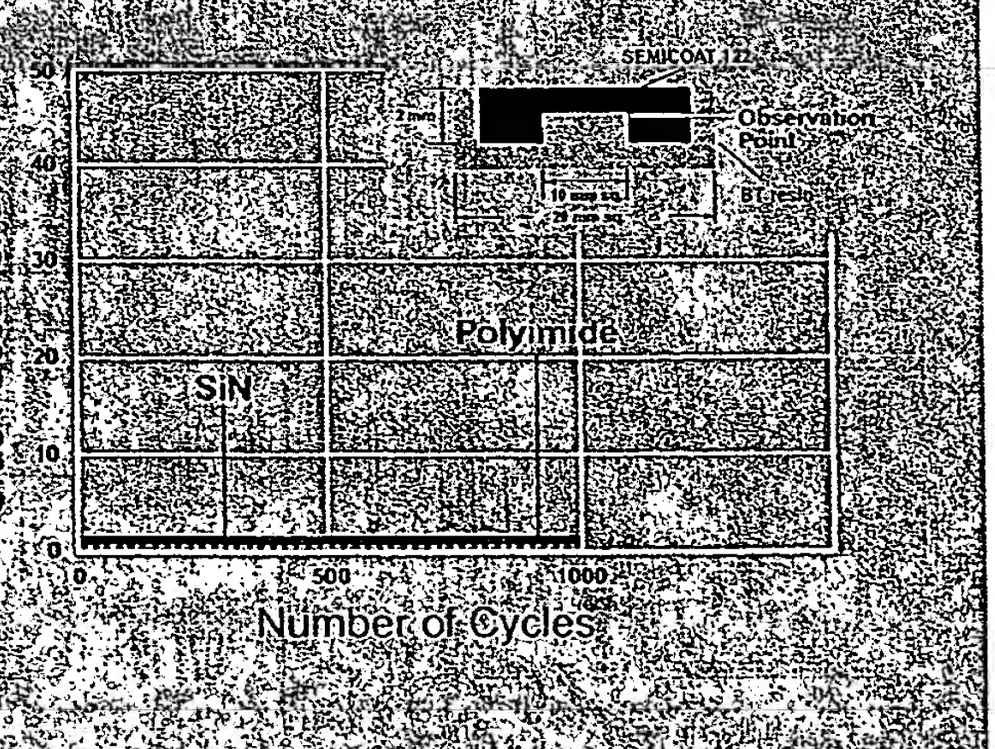
### Delamination during PCT (121℃/2.0atm)




## Excellent Crack Resistane

### Crack Failure during Temperature Cycle

-55℃ (0.5Hr) ~ 125℃ (0.5Hr)




## Popcorn Resistance

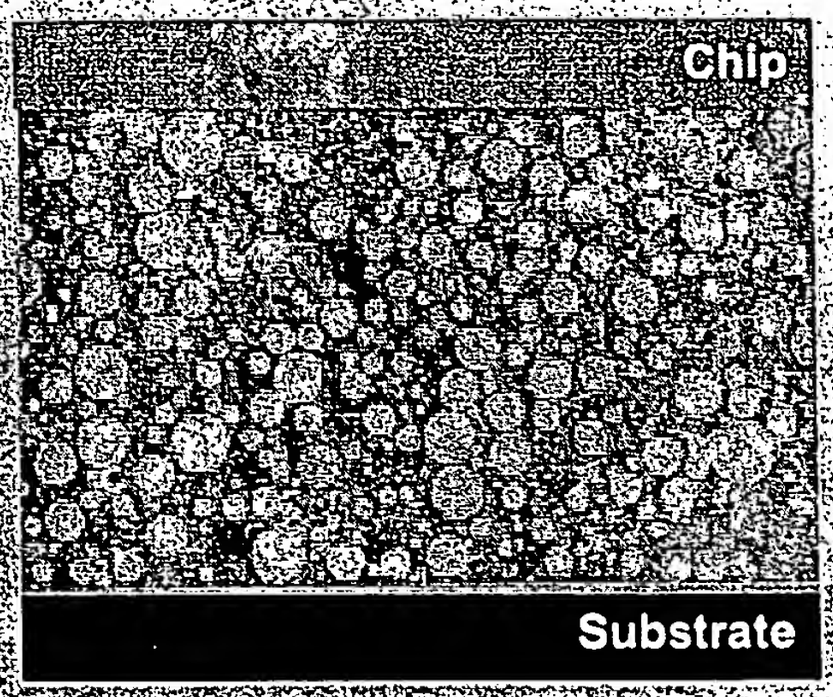
Pass JEDEC Level 3 test

with 35mm sq. BGA device

1. Encapsulated devices are exposed to 30℃/60% RH for 192Hr
2. Devices undergo IR reflow Max 240℃
3. Crack occurrence is checked at the interfacial layer between Polyimide and SEMICOAT

## Underfill

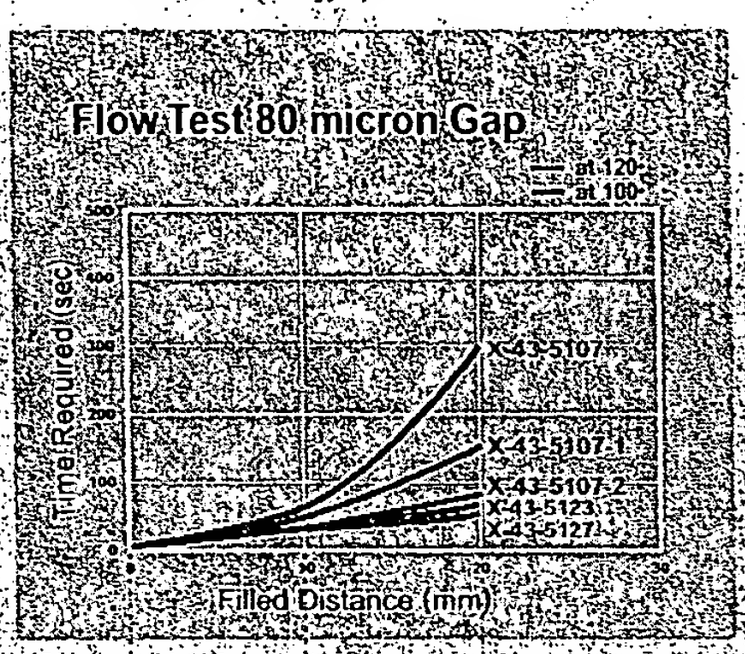
### No Filler Settling



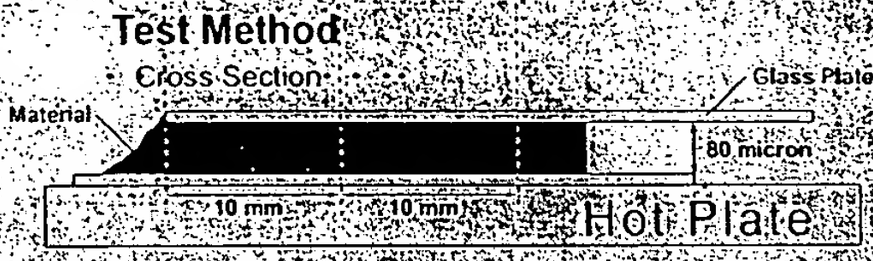

5107 cure condition : 120 /0.5Hr 150 /2Hr

5123 cure condition : 100 /0.5Hr 150 /2Hr

### Penetration Speed

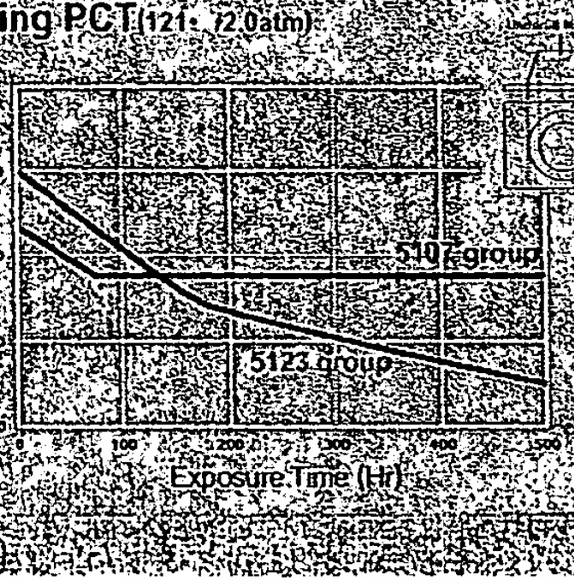



### Test Method

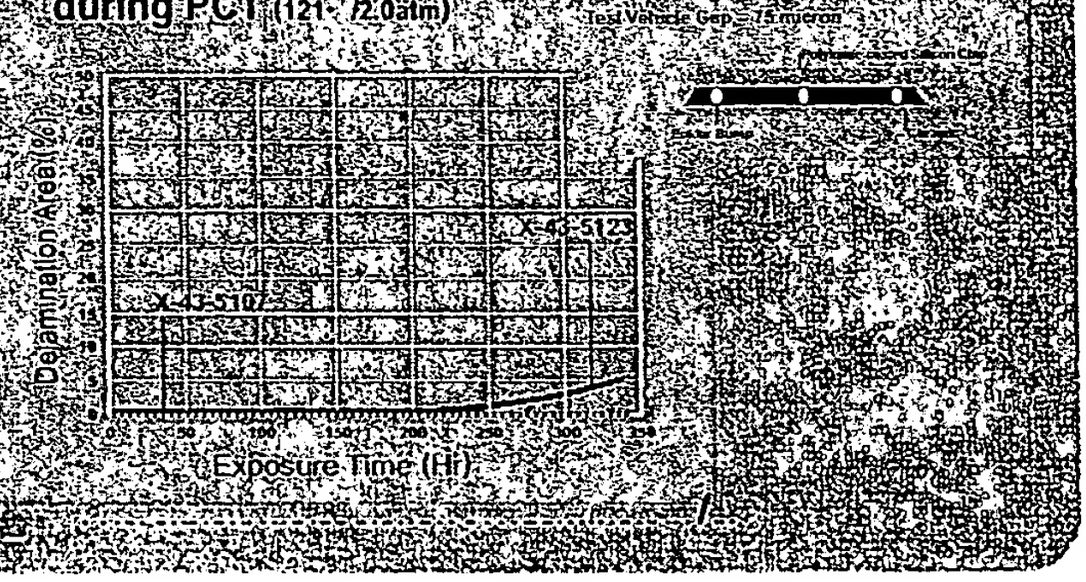



### Excellent Adhesion Property (Less Sensitivity to Moisture)

To Alumina Substrate during PCT (121 /2.0atm)




Delamination during PCT (121 /2.0atm)




## Dam Forming

### Make a Shape Control Easy

Eliminated Cure Process for Dam Forming

Both dam forming agent and potting material can be cured at the same time.

The cure process for dam forming agent is no need, because of its less shape change that might happen between dispense and post cure.

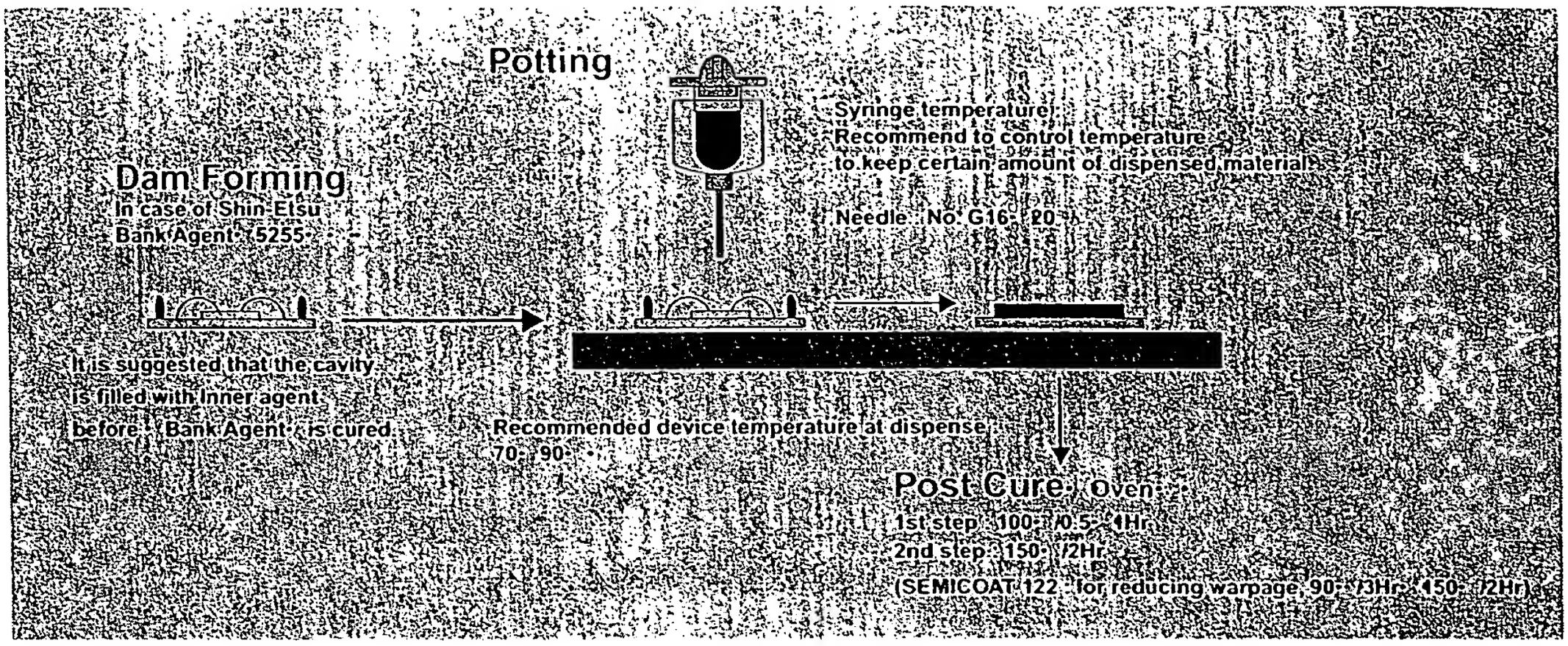
EX.

Dam Forming
5255 dispense

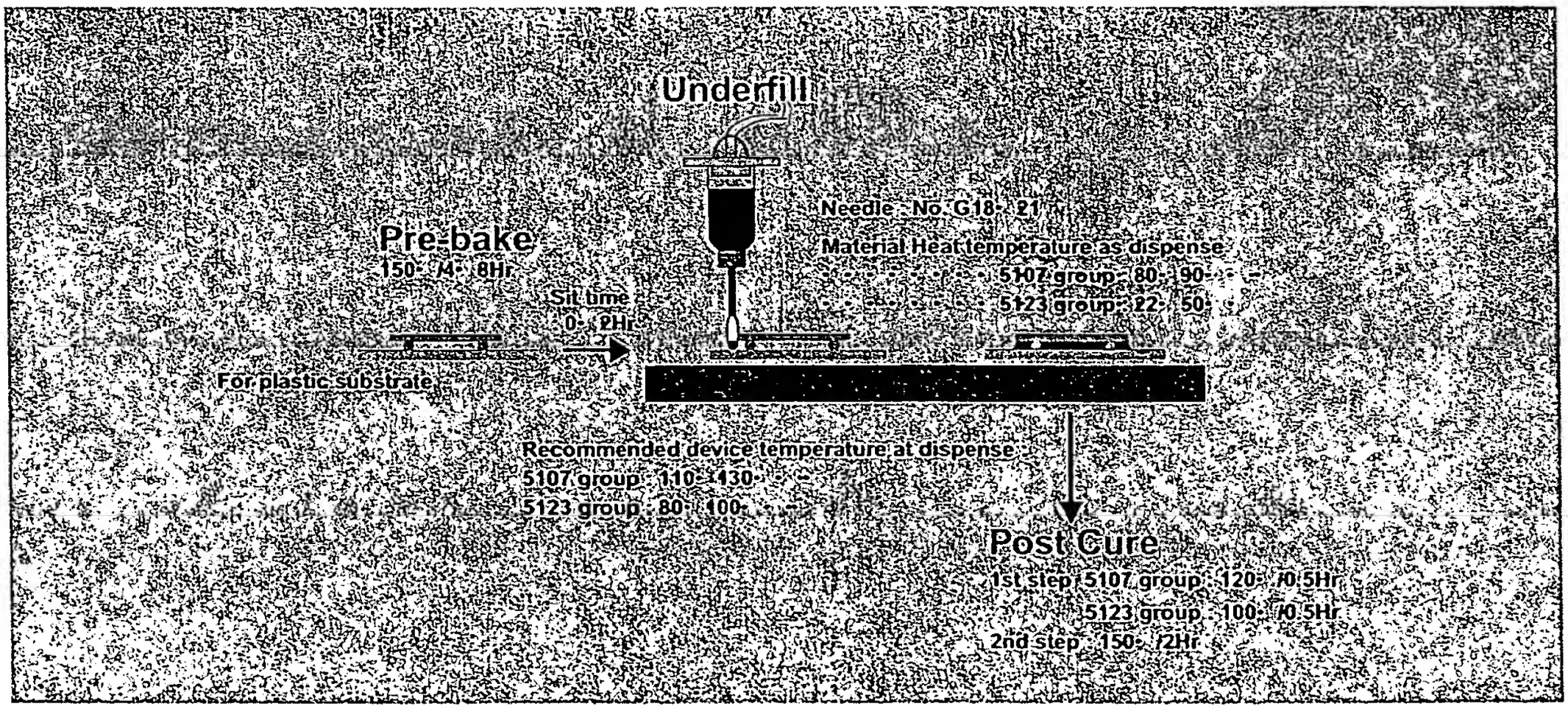
Potting
415 dispense

Cure

## How to Use Potting and Dam Forming Agent




## How to Use Underfill




## Handling

Prior to using the product, remove it from cold storage and return it to ambient temperature.

Keep the product and assembled device dry for optimum performance. Moisture contamination may cause voids and degrade other important characteristics.

For safe handling, avoid skin contact and breathing vapor or dust during the use of this product. It is recommended to wear proper safety gears. If skin contact occurs, wash thoroughly with soap and water.

For details, please refer to MSDS.

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Gunma Complex
ISO 9001
ISO 14001

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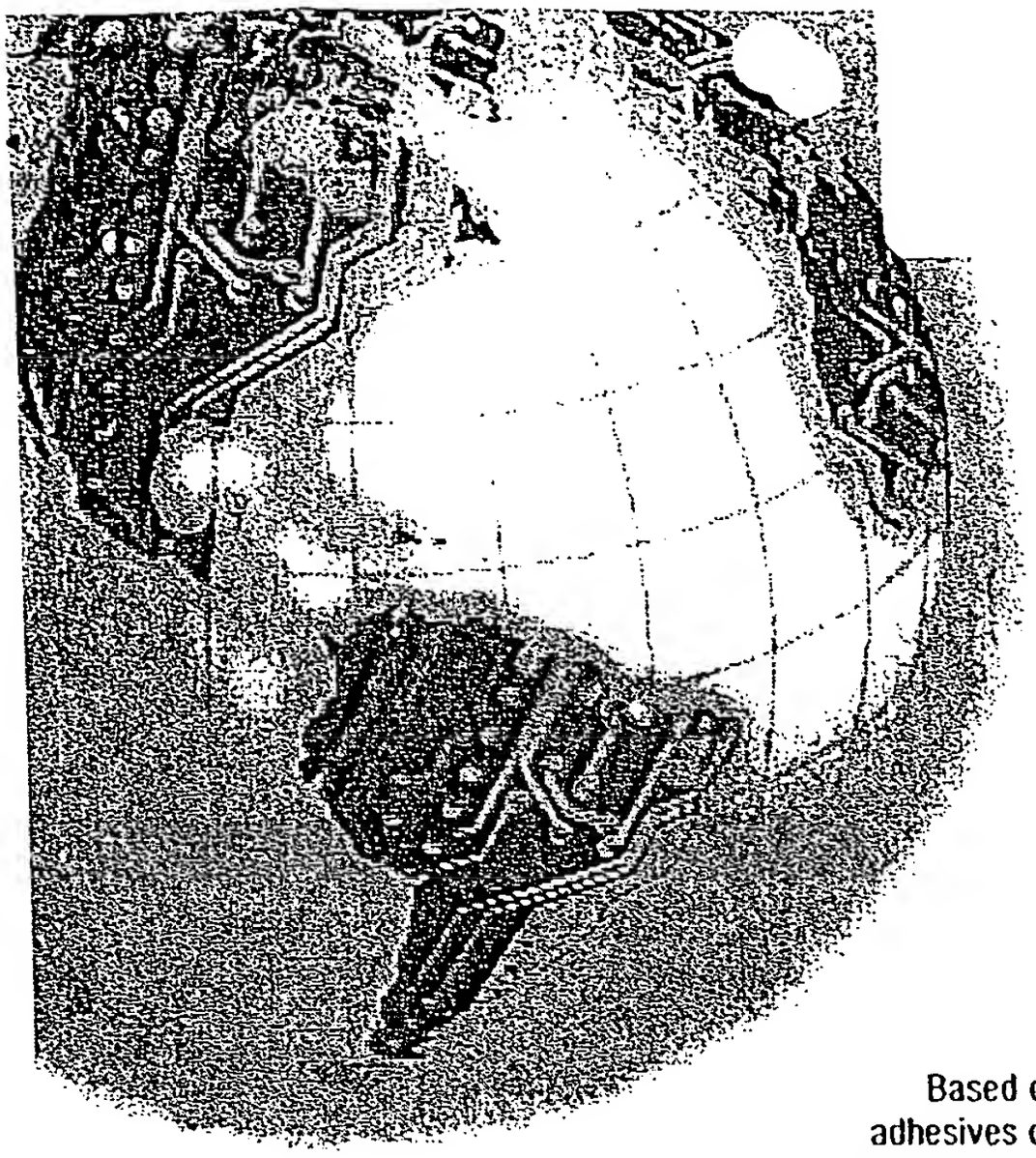


# Hysol® Die Attach Adhesives

Elevated lead-free processing temperatures demand electronic packaging materials that can withstand polymer decomposition during reflow, increased interfacial stresses, and loss of adhesive and cohesive strength.

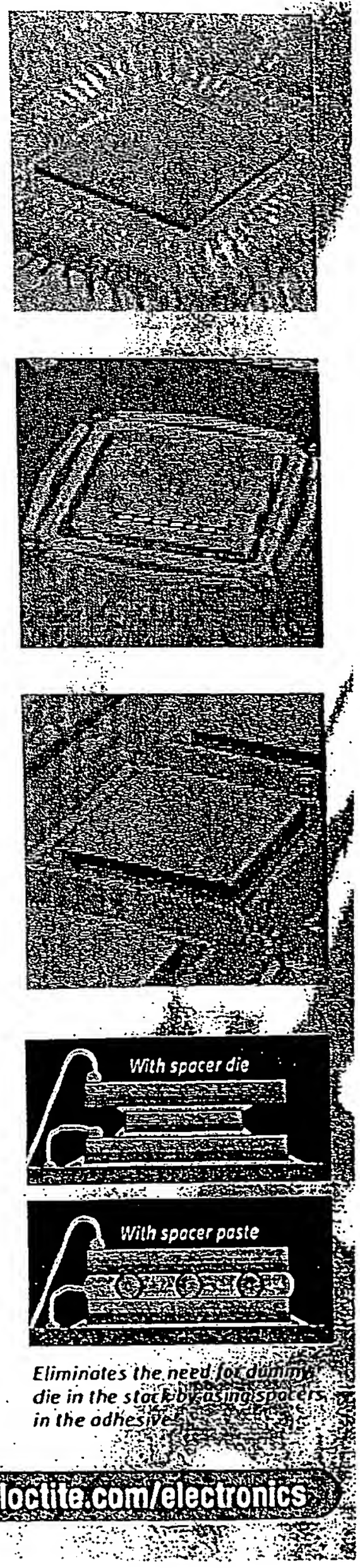
Based on ultra-hydrophobic chemistry, Hysol® die attach adhesives offer very high adhesive strength, elongation at break, and cohesive energy at high reflow temperatures. These properties help electronic packages retain adhesive strength and structural integrity during moisture soak and absorb stresses during the deformations associated with lead free reflow processing.

Designed to deliver superior quality and reliability, Hysol® die attach adhesives have won a number of supplier quality awards. Several products are formulated with PTFE, an extremely low dielectric constant material that will not abrade polyimide and other die passivation.

Our fast reaction kinetics and solvent-free formulation enables inline SkipCure™ processing that increases UPH for adhesive cure, eliminates the need for separate curing equipment, and decreases package warpage. Our adhesives for organic substrates eliminate substrate prebaking, while our patented polymeric spacers deliver consistent bondline thickness, reduce tilt, and enable high UPHs for die placement.

With our products, our customers can use conventional oven cure as well as snap cure, and when they are ready, they can also Skipcure and SkipPrebake[1]. Our organic products can also be converted to their CCSP™ (controlled collapse spacer paste) versions without changing the base paste properties. The ability to exercise these three options, Skipcure, SkiPrebake[1], and Spacers at zero or minimal switching costs allow lower cost of use and lower cost of ownership for our customers equipment.

[1] *For products designed for organic laminates*




*Eliminates the need for dummy die in the stack by using spacers in the adhesive*

# Hysol® Die Attach Adhesives for Non-Hermetic Packages

## For organic substrates including laminates, array, BGA and CSP packages

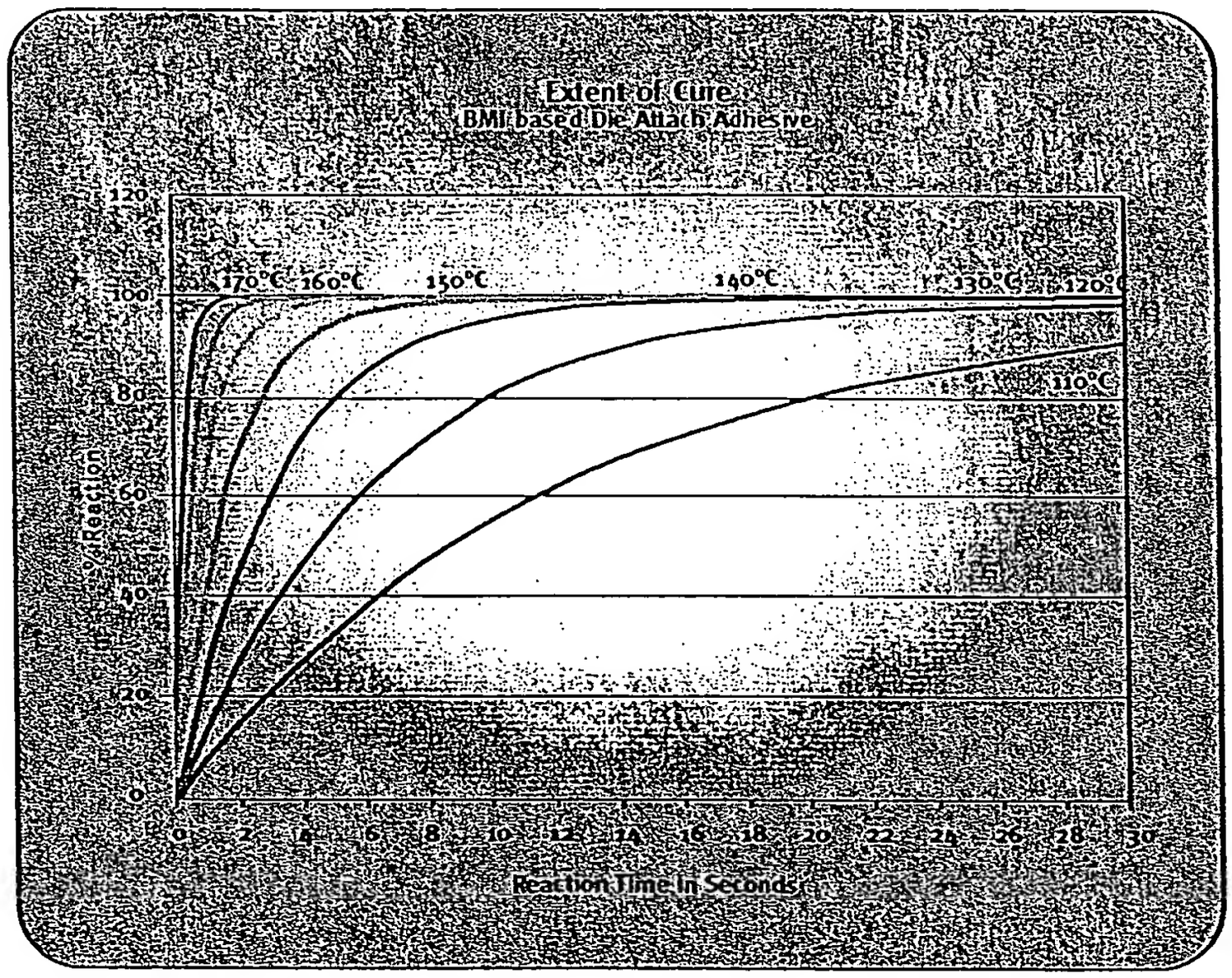
| Materials | Description/Application | Resin | Filler | Oven Cure /SkipCure* | Viscosity 5rpm@ 25°C | Thermal Conductivity | Tg* (°C) | CTE α1/α2 | Modulus @ 25°C | Storage Temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| QMI 550 | Stacked Die in CSP, BGA<br>Dielectric, very high adhesive and cohesive strength and elongation at Pb-free reflow temperatures | BMI | PTFE | 15 min. @ 150°C Oven<br>10 secs. @ 150°C SC | 11500 cps | 0.2 W/m*K | 10 | 91<br>150 | 1.0 GPa | -40°C |
| QMI 536 | Industry Standard<br>De facto industry standard for die-to-die bonding; dielectric, high adhesive strength material for organic substrates | BMI | PTFE | 15 min. @ 150°C Oven<br>10 secs. @ 150°C SC | 9000 cps | 0.3 W/m*K | -31 | 93<br>174 | 0.30 GPa | -40°C |
| QMI 536HT | High Thermal Version of QMI 536<br>Dielectric, high thermal conductivity adhesive for organic laminates and die-to-die bonding; ideal for mixed stacked die applications | BMI | Boron Nitride | 15 min. @ 150°C Oven<br>10 secs. @ 150°C SC | 13000 cps | 0.9 W/m*K | 4 | 66<br>177 | 0.85 GPa | -40°C |
| NEW QMI 550SI | Low CTE Version of QMI 550<br>Silica-filled for low shrinkage and low warpage on laminate and flex substrates | BMI | Silica | 15 min. @ 150°C Oven<br>10 secs. @ 150°C SC | 17000 cps | 0.6 W/m*K | 33 | 43<br>91 | 1.50 GPa | -40°C |
| NEW QMI 550EC | Low CTE, Electrically Conductive<br>Silver filled version of QMI 550; very high adhesive and cohesive strength | BMI | Silver | 15 min. @ 150°C Oven<br>10 secs. @ 150°C SC | 17000 cps | 3.8 W/m*K | 12 | 56<br>148 | 2.8 GPa | -40°C |

## For inorganic substrates including Cu, Pd, Ag & Au plating, ceramic, and black oxide

| Materials | Description/Application | Resin | Filler | Recommended Cure | Viscosity 5rpm@ 25°C | Thermal Conductivity | Tg* (°C) | CTE α1/α2 | Modulus @ 25°C | Storage Temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| QMI 519 | JEDEC Lv 260C for SOIC, QFN<br>De facto industry standard for QFN packages. Good for all preplated leadframes and bare copper. Higher adhesion, excellent electrical and thermal performance. | BMI | Silver | 15 min. @ 185°C Oven<br>10 secs. @ 200°C SC | 9000 cps | 3.8 W/m*K | 75 | 40<br>140 | 5.3 GPa | -40°C |
| NEW QMI 519HT02 | High Thermal Conductivity<br>Very high electrical and thermal conductivity while maintaining excellent adhesion. Suitable for high heat dissipating devices. | BMI | Silver | 15 min. @ 185°C Oven<br>10 secs. @ 200°C SC | 18800 cps | 7.3 W/m*K | 49 | 42<br>104 | 6.70 GPa | -40°C |
| QMI 505MT | For Pd, Alloy 42, Au and Black Oxide<br>Similar to QMI 519 but with superior adhesion to palladium, alloy 42, gold and black oxide finishes | BMI | Silver | 15 min. @ 185°C Oven<br>10 secs. @ 200°C SC | 12100 cps | 2.0 W/m*K | 10 | 47<br>170 | 0.86 GPa | -40°C |
| QMI 518 | Electrically Conductive, Large Die<br>Similar properties to QMI 519, but formulated to have a low modulus to reduce stress on die larger than 500 x 500 mil/13x13 µm | BMI | Silver | 15 min. @ 180°C Oven<br>10 secs. @ 200°C SC | 8500 cps | 1.4 W/m*K | -64 | 69<br>152 | 0.10 GPa | -40°C |
| QMI 534 | Non-Conductive, Small Die<br>Non-conductive, very high adhesive strength on metal substrates for die sizes less than 500 x 500 mil/13x13 µm | BMI | PTFE | 15 min. @ 175°C Oven<br>10 secs. @ 200°C SC | 9000 cps | 0.4 W/m*K | 35 | 87<br>171 | 0.30 GPa | -40°C |
| QMI 538 | Non-Conductive, Large Die<br>Non-conductive, very high adhesive strength on metal substrates for die sizes greater than 500 x 500 mil/13x13 µm | BMI | PTFE | 15 min. @ 175°C Oven<br>10 secs. @ 200°C SC | 8500 cps | 0.3 W/m*K | -70 | 85<br>149 | 0.10 GPa | -40°C |
| QMI 536UV | UV Cure - CCD/CMOS Glass Lid Sealing<br>Non-conductive, UV curing resin with excellent adhesion to glass. Ideal for glass lid sealing CCD or CMOS lenses. | BMI | PTFE | 1 min. @ 100mW/cm2 | 6700 cps | 0.3 W/m*K | 26 | 62<br>136 | 0.7 GPa | -40°C |
| QMI 282HT | Non-conductive, Ultra Low Stress<br>Very low modulus silicone with good thermal properties for low stress, high temperature applications. | Silicone | Alumina & Zinc Oxide | 30 min. @ 150°C or 1hr. @ 120°C<br>(No SkipCure) | 49400 cps | 1.0 W/m*K | -40 | N/A<br>104 | 0.004 GPa | 5°C+/-3°C |
| K00126 | General Purpose Silver, Epoxy<br>Silver filled epoxy for general bonding purposes that require electrical and thermal conductivity. | Epoxy | Silver | 10 min. @ 165°C<br>(No SkipCure) | 9200 cps | 2.1 W/m*K | 96 | 65<br>130 | 4.0 GPa | -40°C |

# Hysol® Die Attach Adhesives for Hermetic Packages

| Materials | Description/Application | Resin | Filler | Recommended Cure | Viscosity 5rpm@ 25°C | Thermal Conductivity | Tg* (°C) | CTE α1/α2 | Modulus @ 25°C | Storage Temp. |
|---|---|---|---|---|---|---|---|---|---|---|
| QMI 301 | Solder and seamed sealed packages. Low temperature cure material with very high adhesion and >340°C temperature resistance for solder-sealed TO- hermetic packages. | Cyanate Ester | Silver | 10 min @ 150°C | 11400 cps | 1.9 W/m°K | 245 | 45<br>85 | 6.9 GPa | -40°C |
| QMI 2419 | **No-dry Ag glass die attach for glass-sealed packages.** Very high thermal conductivity and >450°C temperature resistance. | Glass/Solvent | Silver | See ramp profile 7-10 min @ 420-460°C | 37500 cps | >60 W/m°K | 300 | 21<br>N/A | 15.1 GPa | RT on Rollers |
| QMI 2560 | **No-dry Ag glass die attach for glass, solder, and seamed sealed-packages.** Very high thermal conductivity and applications for die as large as 0.800 square. | Glass/Solvent | Silver | See ramp profile 7-10 min @ 360-440°C | 35800 cps | >60 W/m°K | 250 | 16<br>N/A | 15.1 GPa | RT on Rollers |
| QMI 3555R | **No-dry Ag glass die attach for glass, solder, and seamed sealed-packages.** Very high thermal conductivity and >450°C temperature resistance for glass-sealed hermetic packages. | Glass/Solvent | Silver | See Ramp Profile 7-10 min@ 300-450°C | 40000 cps | >80 W/m°K | 150 | 16<br>N/A | 11.5 GPa | RT on Rollers |




*All Hysol® QMI 500 series die attach adhesives use free radical cure, enabling extremely fast cure rates (Fig.1). Adhesives in this series cure in seconds at the appropriate temperature, instead of minutes or hours. This feature allows the adhesives to be cured in-line right on the diebonder, immediately after the substrate is indexed onto the post-bond cure station or on the wirebonder preheater. This enables high UPH which translates to low total cost-of-use. SkipCure also improves the quality of the cured part. Because the substrate is held down flat during die attach cure, the resulting substrate warpage is much lower than on oven-cured substrates. Furthermore, the short distance between bondsite and post-bond cure station minimizes adhesive slump and die movement before cure, allowing more consistent bondline thickness.*